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NATIONAL DAM SAFETY PROGRAM. JOHNS CR K NUMBER 2 (INVENTORY NU--ETC(U)

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JAMES RIVER BASIN LEVEL II

Name of Dam: Johns Creek No. 2
Location: Craig County, State of Virginia
Inventory Number: VA 04501

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED FOR
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

PREPARED BY
MICHAEL BAKER, JR., INC.
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AUGUST 1979

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Johns Creek No. 2
State: Virginia
County: Craig
USGS 7.5 minute Quadrangle: Waiteville, VA-W.VA
Stream: Little Oregon Creek
Date of Inspection: 10 May 1979

BRIEF ASSESSMENT OF DAM

Johns Creek No. 2 Dam is a zoned, earthfill dam approximately 650 feet long and 51 feet high. The dam, located approximately 18 miles southwest of New Castle, Virginia is used for flood control. Johns Creek No. 2 Dam is an "intermediate" size - "significant" hazard structure as defined by the Recommended Guidelines for Safety Inspection of Dams. Visual inspection and office analyses indicate no deficiencies requiring emergency attention.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the 1/2 Probable Maximum Flood (1/2 PMF) was selected as the spillway design flood (SDF). The SDF was routed through the reservoir and found to overtop the dam by a maximum depth of 2.1 feet with an average critical velocity of 3.8 f.p.s. Total duration of dam overtopping would be approximately 3.2 hours. The spillway is capable of passing only 25 percent of the PMF and is therefore adjudged as inadequate.

The dam and appurtenant structures were found to be in generally good overall condition. No conditions indicating embankment instability were detected during the field inspection and office analyses. Seepage at the toe of the dam is not considered serious; however, it is recommended that the rate be checked for increase at higher reservoir levels. The safety factors determined during design are greater than those required for minimum accepted stability.

It is recommended that the following repair items be accomplished as part of the annual maintenance program: repair rodent holes, remove small trees from the dam, add riprap to the right side of the stilling basin, provide erosion protection for the access road in the emergency spillway, remove debris from the dam slopes, and install a staff gage in the reservoir.

MICHAEL BAKER, JR., INC.

Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer

COMMONWEALTH OF VIRGINIA
MICHAEL
BAKER III
NO. 3176
REGISTERED PROFESSIONAL ENGINEER

SUBMITTED: Original signed by
JAMES A. WALSH

James A. Walsh
Chief, Design Branch

RECOMMENDED: ORIGINAL SIGNED BY:
CARL S. ANDERSON, JR.

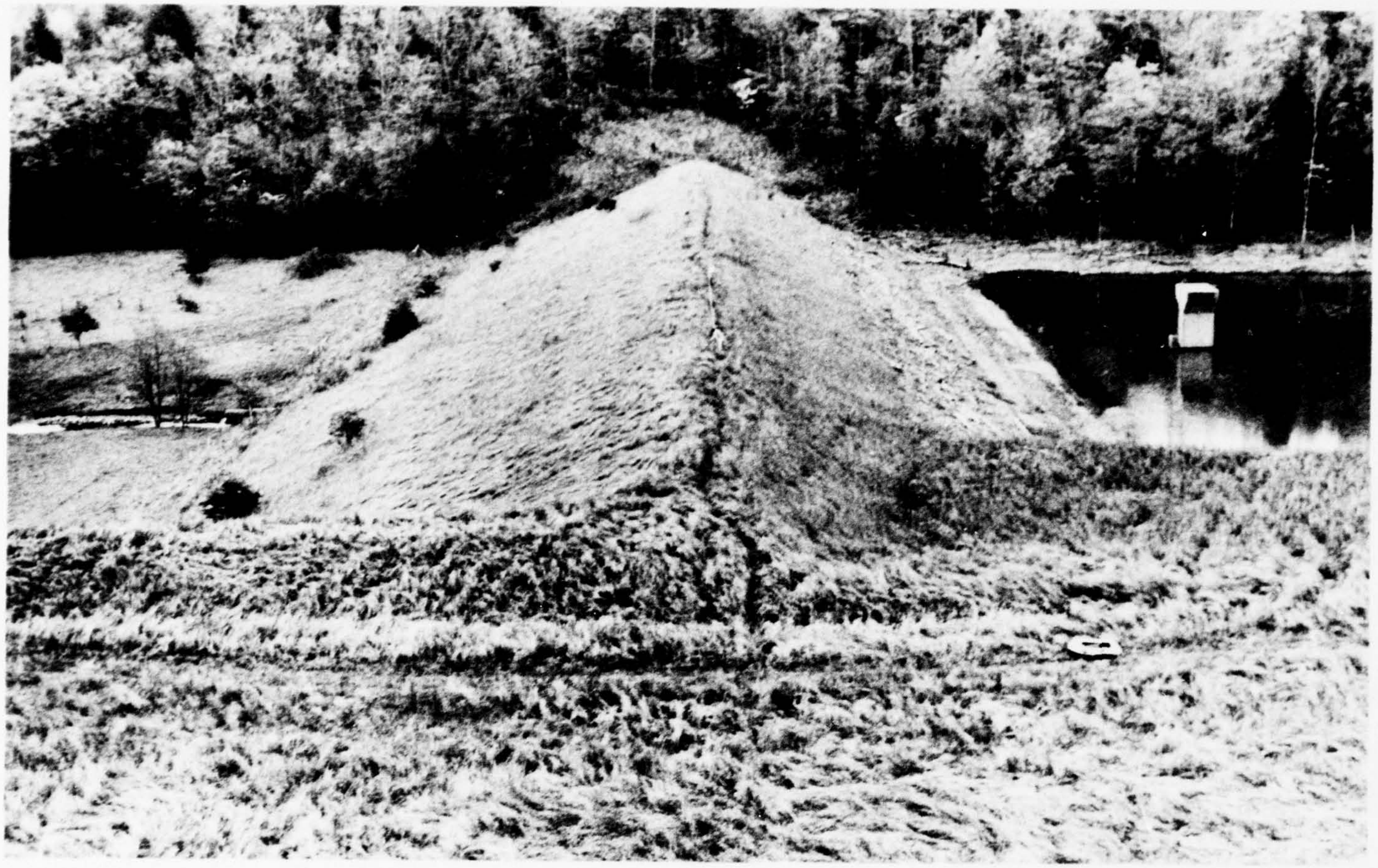
for Jack G. Starr
Chief, Engineering

APPROVED: Original signed by:
Douglas L. Haller

Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: AUG 24 1979

NAME OF DAM: JOHNS CREEK No. 2



OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: JOHNS CREEK No. 2 ID# VA 04501

SECTION 1 - PROJECT INFORMATION

1.1 General

1.1.1 Authority: Public Law 92-367, 8 August 1972 authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: Johns Creek No. 2 Dam consists of a zoned, earthfill embankment approximately 51 feet high[1] and 650 feet long with upstream and downstream slopes of 2.5:1 (horizontal to vertical) and a crest width of 17 feet. A 20 foot berm is provided on the upstream embankment at elevation 1847.0 feet above Mean Sea Level (M.S.L.). Seepage control is provided by an impervious upstream shell, a cut-off trench, and seepage drains. The seepage drains to the left[2] and right[2] of the outlet pipe lie along the toe of the dam and consist of filter material and perforated 6 inch bituminous coated corrugated metal pipe. Both drains exit into the stilling basin on either side of the outlet pipe.

The principal spillway is a drop-inlet structure consisting of a reinforced concrete riser, a 30 inch diameter reinforced concrete outlet pipe, and a riprap-lined stilling basin approximately 20 feet wide and 60 feet long.

[1] Height from downstream toe to crest.
[2] Facing downstream.

The 100 foot wide, vegetated, earth channel, emergency spillway is located outside the left abutment of the dam. The approach channel slope is approximately 2 percent to the 30 foot long level control section. The discharge slope of the emergency spillway is approximately 3 percent.

The secondary level orifice-inlet located on the downstream side of the riser is 12 inches by 18.5 inches and has an invert elevation of 1846.5 feet M.S.L. The high stage riser is at elevation 1863.4 feet M.S.L. A 24 inch pond drain with a manually operated sluice gate is provided at the bottom of the riser (invert elevation 1832.9 feet M.S.L.). The plan and typical sections of the dam are shown in Plates 2 and 3.

1.2.2 Location: Johns Creek No. 2 Dam is located on Little Oregon Creek approximately 18 miles southwest of New Castle, Craig County, Virginia. A Location Plan is included in this report.

1.2.3 Size Classification: The maximum height of the dam is 51 feet and the reservoir storage capacity to the top of dam (elevation 1879.4 feet M.S.L.) is 1334 acre-feet. Therefore, the dam is in the "intermediate" size category as defined by the *Recommended Guidelines for Safety Inspection of Dams*.

1.2.4 Hazard Classification: The dam is located in a rural area where failure may damage some pastures, fields, and a few isolated homes; however, loss of life is not considered probable. Several farm buildings are located approximately 1 mile downstream of the dam. In the event of a failure of the dam, loss of livestock and damage to farmland are likely in these areas. Therefore, this dam is considered in the "significant" hazard category as defined by the *Recommended Guidelines for Safety Inspection of Dams*. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The dam is owned by Mr. Elridge Huffman, Box 341, New Castle, Virginia 24127.

1.2.6 Purpose of Dam: The dam is used for flood control within the James River Basin.

1.2.7 Design and Construction History: The existing facility was designed by the U.S. Department of Agriculture, Soil Conservation Service (SCS). The dam, completed in 1967, was built by Branch and Associates, Inc.

1.2.8 Normal Operational Procedures: The reservoir is maintained at normal pool by the secondary level orifice-inlet, elevation 1846.5 feet M.S.L. No formal operating procedures are followed for the dam. For a more detailed operating assessment, see paragraph 4.1.

1.3 Pertinent Data

1.3.1 Drainage Area: The drainage area for Johns Creek No. 2 Dam is 5.63 square miles.

1.3.2 Discharge at Dam Site: The maximum discharge at the dam site is unknown.

Principal Spillway:
Pool level at top of dam . . 133 c.f.s.

Emergency Spillway:
Pool level at top of dam . . 5329 c.f.s.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet M.S.L.	Reservoir Area acres	Reservoir Capacity Acre-feet(a)	Reservoir Capacity Watershed inches	Reservoir Length feet
Top of dam	1879.4	80.8	1334	4.44	6200
Emergency spillway crest	1872.4	60.1	846	2.82	5000
Principal spillway crest	1863.4	30.3	426	1.42	3800
Secondary level orifice invert (normal pool)	1846.5	10.8	66	0.22	2000
Streambed at downstream toe of dam	1828±	-	-	-	-

NAME OF DAM: JOHNS CREEK No. 2

SECTION 2 - ENGINEERING DATA

2.1 Design: The site was investigated and the embankment designed by the SCS. The dam in underlain with black fissle shale. Resistivity surveys indicated that the bedrock is weathered to depths of 6 to 8 feet, slightly weathered to depths of 15 to 20 feet and unweathered of greater depths (for a complete geologic report, see Appendix VII). The soil available from the borrow area consists of clays, silts, sands, and gravels.

The embankment was constructed in three sections. The upstream section, which includes the cut-off trench, consists of inorganic clays (CL) and inorganic silts (ML). The CL material had saturated shear valves of $\emptyset = 24.5°$ and c = 100 p.s.f., while the ML material has consolidated, undrained shear valves of $\emptyset = 29°$ and c = 425 p.s.f. The maximum density of the CL material was 106.0 p.c.f. of an optimum moisture content of 19.0 percent. The ML material had a maximum density of 103.0 p.c.f. at an optimum moisture content of 21.0 percent. The second section or embankment core is constructed of shale compacted to a maximum density of 120 p.c.f. at approximately 95 percent of standard. The final section or downstream shell consists of CL, clayey sands, and silty sands (SC-SM). The CL properties are the same as for the upstream shell, with the SC-SM having a maximum density of 113.5 p.c.f. and a moisture content of 14.5 percent. The saturated shear strength valves for the SC-SM material were given as $\emptyset = 24.0°$ and c = 400 p.s.f.

The following is a list of conclusions and recommendation made by the SCS for construction of the embankment.

1) If the weathered shale is assumed impermeable, cut-off the soils to bedrock and use a relatively shallow drain for control of the phreatic surface.

2) If the shale is not assumed to be impermeable, cut-off the disturbed surface material and install a trench drain with the drain bottom on bedrock.

3) A fine aggregate can be used for the drain with a top width of 12 to 15 feet.

4) A 2.5H:1V upstream slope with a 20 foot berm at elevation 1847.5 feet M.S.L. is recommended with a 2.5H:1V downstream slope.

The stability analysis, using the Swedish Circle Method with a maximum safety factor of 1.37, was calculated for the upstream slope assuming full drawdown with a 20 foot berm at elevation 1847.5 feet M.S.L. and a 2.5H:1V slope above and 3H:1V below the berm. The downstream slope had a safety factor of 1.68 with a 2.5H:1V slope and a c/b = 0.6. (See Appendix VI for complete analysis and drawings.)

The emergency spillway required no special foundation treatment.

2.2 Construction: The dam, constructed by Branch and Associates, Inc., was completed in 1967. Construction records were not available for this inspection; however, as-built drawings were reviewed and were subsequently verified in the field. Construction reports are on file in Washington, District of Columbia.

2.3 Operation: There are no formal operating procedures for this dam. The previous maximum discharge at the dam site is unknown. No operational records are available nor are there any records of operational equipment checks.

2.4 Evaluation

2.4.1 Design: The as-built drawings and design report were adequate to assess all aspects of design. The hydrologic and hydraulic data provided was adequate for design review. The assessments made in this report are based on this design data along with field observations.

2.4.2 Construction: No construction records were available for review. The as-built drawings do not indicate that any changes or modifications were made during the construction.

2.4.3 Operation: Annual operation and maintenance inspection reports were available for review (see Appendix V).

SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: The field inspection was made on 10 May 1979; the reservoir was at normal pool. The temperatures were in the high 80's F. and the skies were clear. The ground conditions were generally dry at the time of the inspection. The dam and appurtenant structures were observed to be in generally good condition. The deficiencies found were: damaged riprap and erosion along the stilling basin, considerable accumulation of trash and debris along the reservoir and upstream embankment slopes, and erosion of a portion of the access road to the emergency spillway. Plate 1 is a Field Sketch of conditions found at the time of the inspection. The complete visual inspection check list is enclosed as Appendix III. The following are brief summaries of conditions found during the inspection.

3.1.2 Dam: The dam appears to be stable, with no slumps, bulges, or other signs of movement. The cross-section of the dam along the axis of the principal spillway agrees with the as-built drawings. The right downstream embankment slope contains some clear seepage (too small to measure) which originates in the lower part of the riprap-lined ditch, along the juncture of the embankment with the right abutment, and extends toward the downstream channel. The left toe area contains a small quantity (immeasurable) of clear seepage.

The vegetative cover (Sericea) on the dam is well developed. There are scattered, low trees on the embankment (see Photos 3 and 4) and several rodent holes were noted on the downstream slope above the outlet pipe. There is a heavy accumulation of debris (see Photo 2) on the upstream embankment slope, consisting largely of fallen trees, limbs, and brush. The lower portion of the riprap-lined ditch on the right side is obscured by this debris (see Photo 1). Deep erosion is occurring on the access road in the discharge channel of the emergency spillway, down slope from an area which has been repaired in the past with rock fill.

3.1.3 Appurtenant Structures: No apparent structural deficiencies were found during the inspection.

3.1.4 Reservoir Area: No unstable slopes were apparent in the reservoir area. The slopes are moderate and covered with a heavy growth of mixed hardwoods and softwoods. There is a significant accumulation of fallen trees, particularly on the left side. These dead trees probably become submerged during high water and may be one of the sources of debris.

3.1.5 Downstream Channel: Sections of the riprap in the stilling basin (see Photo 8) are in poor condition and in need of repair. In particular, riprap on the right side has failed and the adjacent area is severely eroded. Otherwise, the downstream channel is unobstructed and the outlet works are in good condition (see Photo 10).

3.2 Evaluation: Although the dam appears to be in a generally good condition, several maintenance functions are necessary. Additional riprap should be placed on the right side of the stilling basin where high discharges have severely eroded the banks. The significant amount of debris on the upstream embankment slope should be removed, including the dead trees in the reservoir area. The trees on the embankment should be removed and the rodent holes backfilled and compacted. Although not directly related to dam stability, the eroded section of the access road in the discharge channel of the emergency spillway should be repaired and proper drainage provided.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: The reservoir level is maintained at normal pool elevation 1846.5 feet M.S.L. by means of the secondary level orifice-inlet located on the downstream side of the riser. During periods of heavy inflow, the excess water is diverted around the dam by means of the emergency spillway. The main embankment is protected from erosion caused by flow through the emergency spillway channel by means of a 225 foot berm placed perpendicular to the centerline of the dam and extending 150 feet in the downstream direction. This berm directs flow through the discharge channel to a point below the dam where it enters the downstream channel.

4.2 Maintenance of Dam: The Natural Bridge Soil and Water Conservation District personnel along with local SCS representatives perform an annual inspection of the dam. Maintenance of the dam is provided by the Natural Bridge Soil and Water Conservation District.

4.3 Maintenance of Operating Facilities: Maintenance of the operating equipment is provided by the Natural Bridge Soil and Water Conservation District.

4.4 Warning System: At the present time, there is no formal warning system or evacuation plan in operation.

4.5 Evaluation: Maintenance of the dam is considered adequate.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 Design: Normal pool (elevation 1845.6 feet M.S.L.) is maintained by a 12 by 18.5 inch secondary level orifice-inlet on the downstream face of the concrete riser. The orifice invert was established at the elevation sufficient to store the 50-year sediment accumulation. The riser crest elevation (1863.4 feet M.S.L.) was established at the minimum elevation to store an additional 1.2 inches of runoff above normal pool. The capacity (123 c.f.s. with the reservoir level at the emergency spillway crest) of the principal spillway was established by consideration of a number of factors including:

1) The capability of evacuating the flood storage space within a reasonable time (less than 10 days).

2) Not passing damaging floods downstream.

3) The capability of the reservoir to store the floodwaters.

The crest (elevation 1872.4 feet M.S.L.) of the emergency spillway was established at the elevation needed to store the 50-year flood. The elevation of the top of dam (1879.4 feet M.S.L.) was established by use of the freeboard hydrograph. The freeboard hydrograph was developed by the SCS for a class "b" structure and was obtained by utilizing the 6-hour storm rainfall of 14.1 inches to produce a storm runoff of 10.16 inches.

5.2 Hydrologic Records: No rainfall or stream flow records were available at the dam site.

5.3 Flood Experience: No exact high water marks were available. However, it is apparent from the trash line along the face of the dam, that water in the reservoir has reached an elevation of at least 1863.4 feet M.S.L. in the past.

5.4 Flood Potential: The Probable Maximum Flood (PMF) and 1/2 Probable Maximum Flood (1/2 PMF) were developed and routed through the reservoir by use of the HEC-1 DB computer program (Reference 9, Appendix VIII) and appropriate unit hydrograph, precipitation, and storage-outflow data. Clark's T_c and R coefficients for the local drainage areas were estimated from basin characteristics. The rainfall applied to develop the unit hydrograph was obtained from the U.S. Weather Bureau's publications (References 5 and 16, Appendix VIII). The

inflow hydrograph for the PMF was developed by the Corps of Engineers using a rainfall of 33.3 inches producing a runoff of 30.7 inches. Losses were estimated at an initial loss of 1.0 inch and a constant loss thereafter of 0.05 inch per hour.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1, paragraph 1.3.3.

Regulation of flow from the reservoir is automatic. Normal flows are maintained by the secondary level orifice-inlet in the riser with an elevation of 1846.5 feet M.S.L., and the crest of the riser with an elevation of 1863.4 feet M.S.L. Water entering the inlets flows through the dam in a 30 inch diameter reinforced concrete conduit. Water also flows past the dam through the ungated, vegetated, emergency spillway in the event water in the reservoir rises above an elevation of 1872.4 feet M.S.L.

Outlet discharge capacity, and reservoir area and storage capacity were taken from the SCS Design Report. Hydrograph data and routing computations for PMF and 1/2 PMF were computed as part of this report. The flood routings were begun with the reservoir level at normal pool.

5.6 Overtopping Potential: The probable rise of the reservoir and other pertinent information on reservoir performance are shown in the following table:

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal	Hydrographs 1/2 PMF	PMF(a)
Peak flow, c.f.s.			
Inflow	6	13,700	27,300
Outflow	6	13,500	27,200
Peak elev., ft. M.S.L.	1846.5	1881.5	1883.8
Emergency spillway (b) (elev. 1872.4 ft. M.S.L.)			
Depth of flow, ft.	-	8.6	10.7
Average velocity, f.p.s.	-	5.3	6.5
Duration of flow, hrs.	-	15.4	18.0
Non-overflow section (elev. 1879.4 ft. M.S.L.)			
Depth of flow, ft.	-	2.1	4.4
Average velocity, f.p.s.	-	3.8	5.6
Total duration of overtopping, hrs.	-	3.2	5.2
Tailwater elev., ft. M.S.L.	1828.6(c)	-	-

(a) The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in a region.
(b) Estimated depth and velocity at control section.
(c) Tailwater at time of inspection.

5.7 Reservoir Emptying Potential: A 24 inch sluice gate on the upper face of the riser (elevation 1832.9 feet M.S.L.) is available to dewater the reservoir. According to the SCS Design Report, the time for the reservoir level to decrease from the emergency spillway crest (elevation 1872.4 feet M.S.L.) to the riser crest (elevation 1863.4 feet M.S.L.) is approximately 2 days. From this level, it would take approximately 8 days to return to the secondary level orifice invert (elevation 1846.5 feet M.S.L.). The reservoir drawdowns, as determined by the SCS, were computed neglecting inflow.

5.8 Evaluation: Johns Creek No. 2 Dam is an "intermediate" size-"significant" hazard dam requiring evaluation for a spillway design flood (SDF) equal to the 1/2 PMF. The 1/2 PMF was routed through the reservoir and found to overtop the dam by a maximum depth of approximately 2.1 feet with an average velocity of 3.8 f.p.s. Total duration of dam overtopping would be approximately 3.2 hours. The spillway is capable of passing only 25 percent of the PMF.

Conclusions pertain to present day conditions and the effect of future development on the hydrology has not been considered.

SECTION 6 - DAM STABILITY

6.1 <u>Foundation and Abutments</u>: Foundation conditions were obtained from laboratory analyses; field observations; and boring, test pit, and resistivity survey information.

The embankment is founded on shale with the overlying soil having been excavated for the foundation. The suggested settlement was 1.3 feet; 0.2 feet for the foundation and 1.1 feet or 2.5 percent for the embankment. Positive cut-off was obtained beneath the embankment by removing the disturbed, weathered surface material and installing a trench drain with the drain bottom on sound bedrock.

6.2 <u>Stability Analysis</u>

6.2.1 <u>Visual Observations</u>: No evidence of movement, i.e., bulging, tension cracks, or slumping, was noted anywhere on the embankment or beyond the toe. No seepage on the embankment slopes was recorded although a small amount (immeasurable) was found at the downstream embankment toe, as described in paragraph 3.1.2.

6.2.2 <u>Design Data</u>: The SCS used the Swedish Circle Method for the dam stability analysis, with various strength parameters for foundation soils and for embankment construction materials. All strength data was obtained from triaxial test results. Analyses were made for full drawdown conditions, using saturated shear values. As a result of its analyses, the SCS recommended construction of a uniform 2.5:1 downstream embankment slope (minimum safety factor of 1.75 assuming $\phi = 35.5°$ and c = 0 p.s.f. for foundation soils and for the zoned embankment materials, $\phi = 24.0°$ and c = 400 p.s.f. for the SC-SM material, $\phi = 34.5°$ and c = 200 p.s.f. for the shale in the embankment, and $\phi = 39.0°$ and c = 425 p.s.f. for the ML material). With these same parameters, the SCS recommended a 2.5:1/3:1 slope on the upstream side with a 20 foot wide berm at elevation 1847.5 feet M.S.L.; at the 2.5:1/3:1 break point, the minimum safety factor was 1.36.

6.2.3 <u>Operating Records</u>: The SCS operation and maintenance inspection reports made since

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January 1975 do not indicate any problems relating directly to embankment stability. However, the following specific deficiencies were found:

1) 9 January 1975: Some erosion was occurring on the same area below the emergency spillway which was damaged and subsequently repaired following the 28 May 1973 storm.

2) 19 August 1975: An active gully, 1 to 2 feet in depth and more than 200 feet long, was cutting into the access road.

3) 1976: The gully in the access road was repaired. There was some debris around the first stage riser intake and considerably more on the dam and south bank of the reservoir. Bare vehicle tracks were reported on the emergency spillway.

4) 14 May 1977: The low stage orifice contained a small amount of debris; the lessor was to be contacted to remove the obstruction. The access road was eroding beside the stone that was placed in 1976 and repairs were to be arranged.

6.2.4 Post-Construction Changes: There have been no known changes to the dam or its appurtenant structures since construction was completed.

6.2.5 Seismic Stability: The dam is located in Seismic Zone 2 and is considered to have no hazard from earthquakes, according to the Recommended Guidelines for Safety Inspection of Dams, provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: The recommended design is compatible with the as-built drawings. However, the clear seepage at the toe of embankment should be inspected during periods of high reservoir levels to detect any significant increases in flow rates and any signs of turbid discharge. If significant increases in flow are observed or discoloration of the water occurs, the stability of the dam should be further evaluated. The calculated

safety factors are greater than those required for minimum accepted stability. The berm separating the crest and emergency spillway is made of the same material as the embankment. No stability analysis was made of the berm and there is no evidence of instability. No erosion protection is provided along the slopes of the diversion berm, however, riprap placed along the sides of the emergency spillway channel would prevent erosion.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The dam and appurtenant structures are generally in good overall condition. No deficiencies were discovered during the field inspection and office analysis which would indicate the need for emergency attention. Riprap on the slope of the berm on the right side of the emergency spillway would prevent erosion during high flows.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the 1/2 PMF was selected as the SDF for the "intermediate" size-"significant" hazard classification of Johns Creek No. 2 Dam. It has been determined that the dam would be overtopped by the SDF by a maximum depth of 2.1 feet with average critical velocity of 3.8 f.p.s. and would remain above the top of dam for 3.2 hours. The spillway is therefore adjudged as inadequate.

The seepage at the downstream toe was too small to measure and therefore is not considered a threat to the stability of the embankment. However, the reservoir, at normal pool during the inspection, only created a head of approximately 12 feet and therefore the condition did not represent the most serious seepage condition that may occur. For this reason the seepage rate should be checked for increased flow at times when the reservoir is at higher levels. An increase in the seepage rate could lead to piping and thereby affect the structural integrity of the dam.

The recommended remedial measures are not considered urgent and, therefore, may be accomplished as part of the annual maintenance and inspection program.

7.2 Recommended Remedial Measures: The following repair items should be completed as part of general maintenance of the dam:

1) Excavate, compact, and fill rodent holes.

2) Remove the small tree growth on the embankment.

3) Remove the debris accumulated on the upstream embankment and abutments to prevent clogging of the riser outlets during high periods of runoff.

4) Provide additional riprap on the right downstream side of the stilling basin.

5) Repair erosion on the access road to the emergency spillway and provide proper drainage.

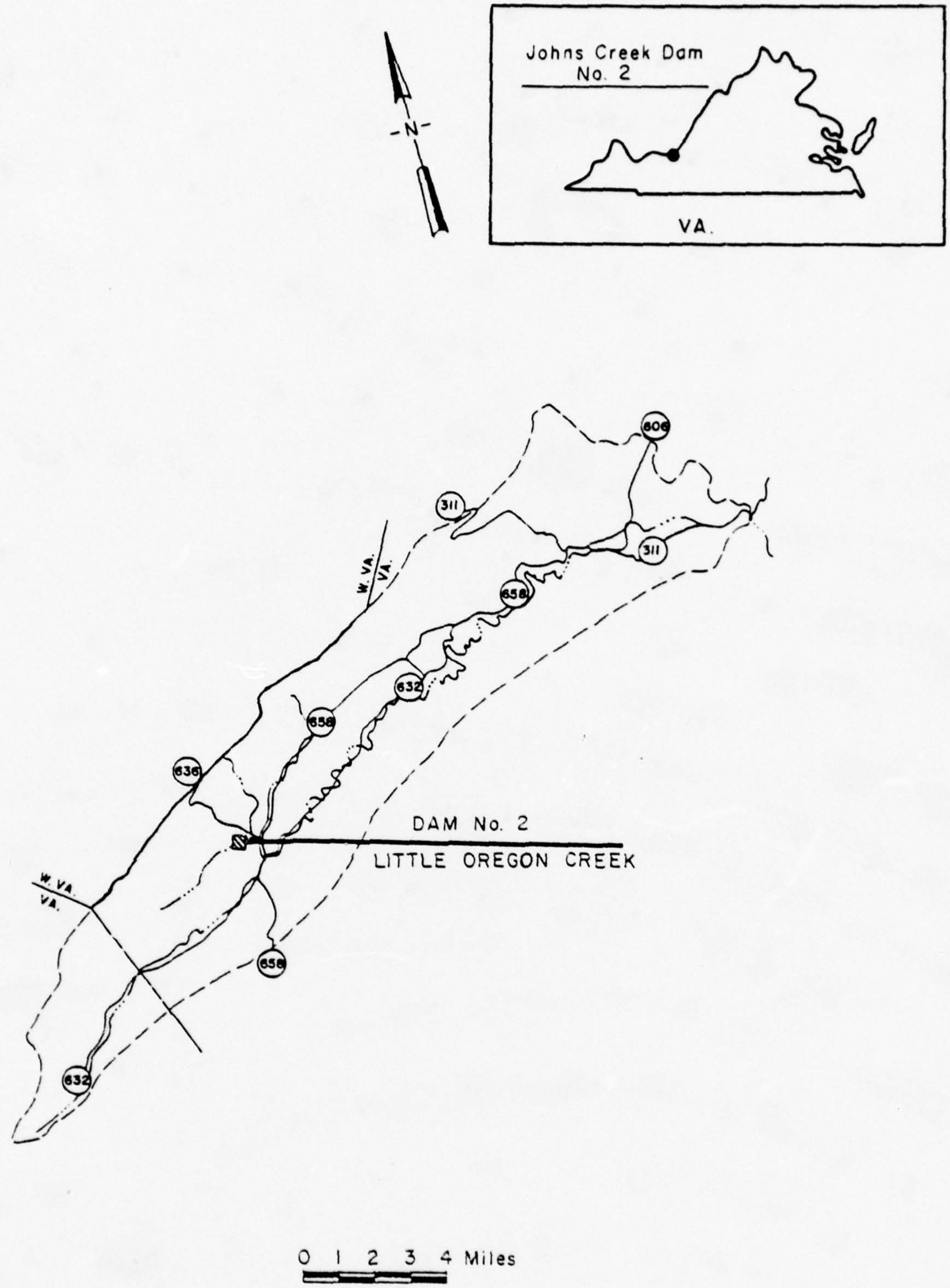
6) Install a staff gage to monitor reservoir levels above normal pool.

APPENDIX I

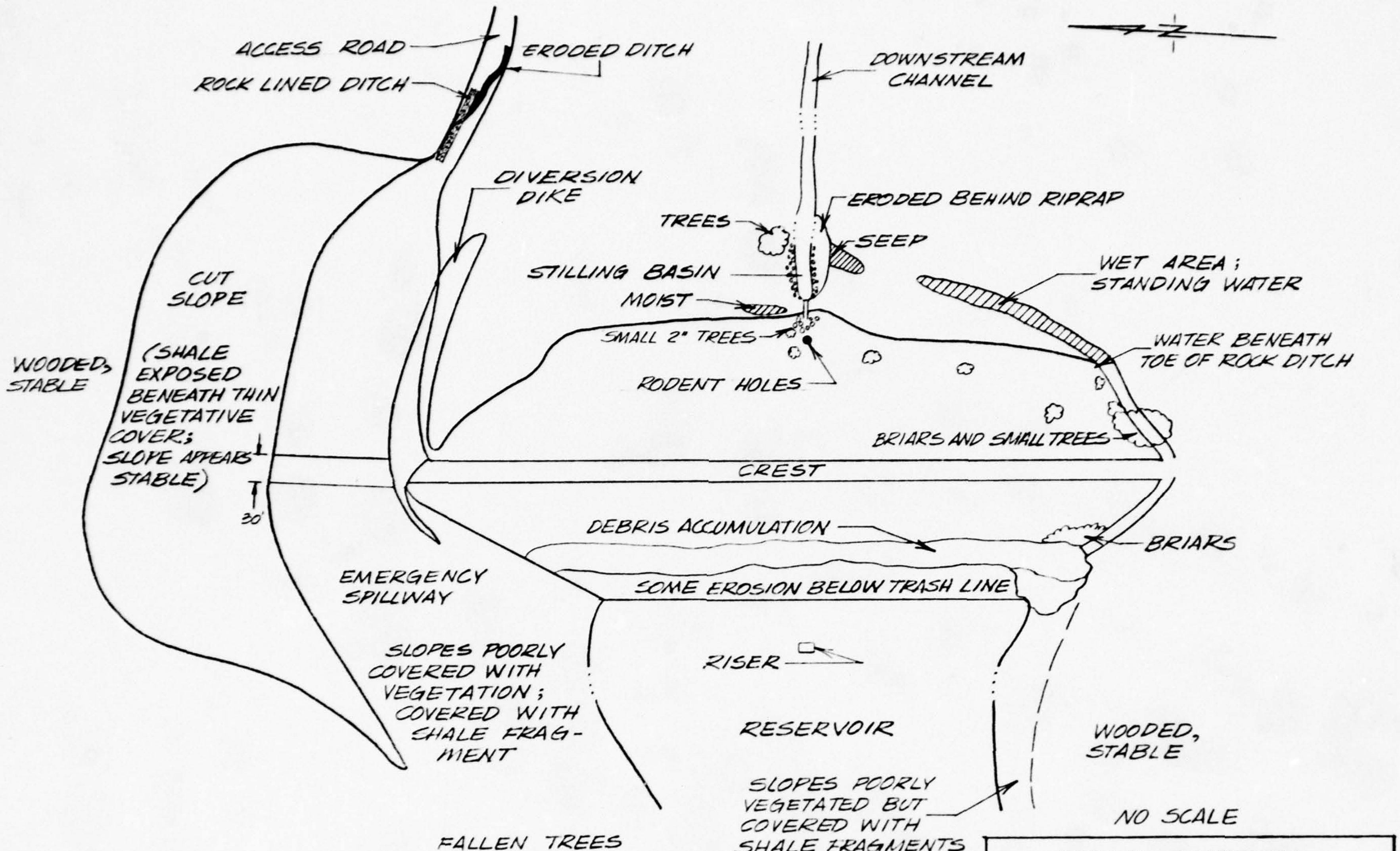
PLATES

CONTENTS

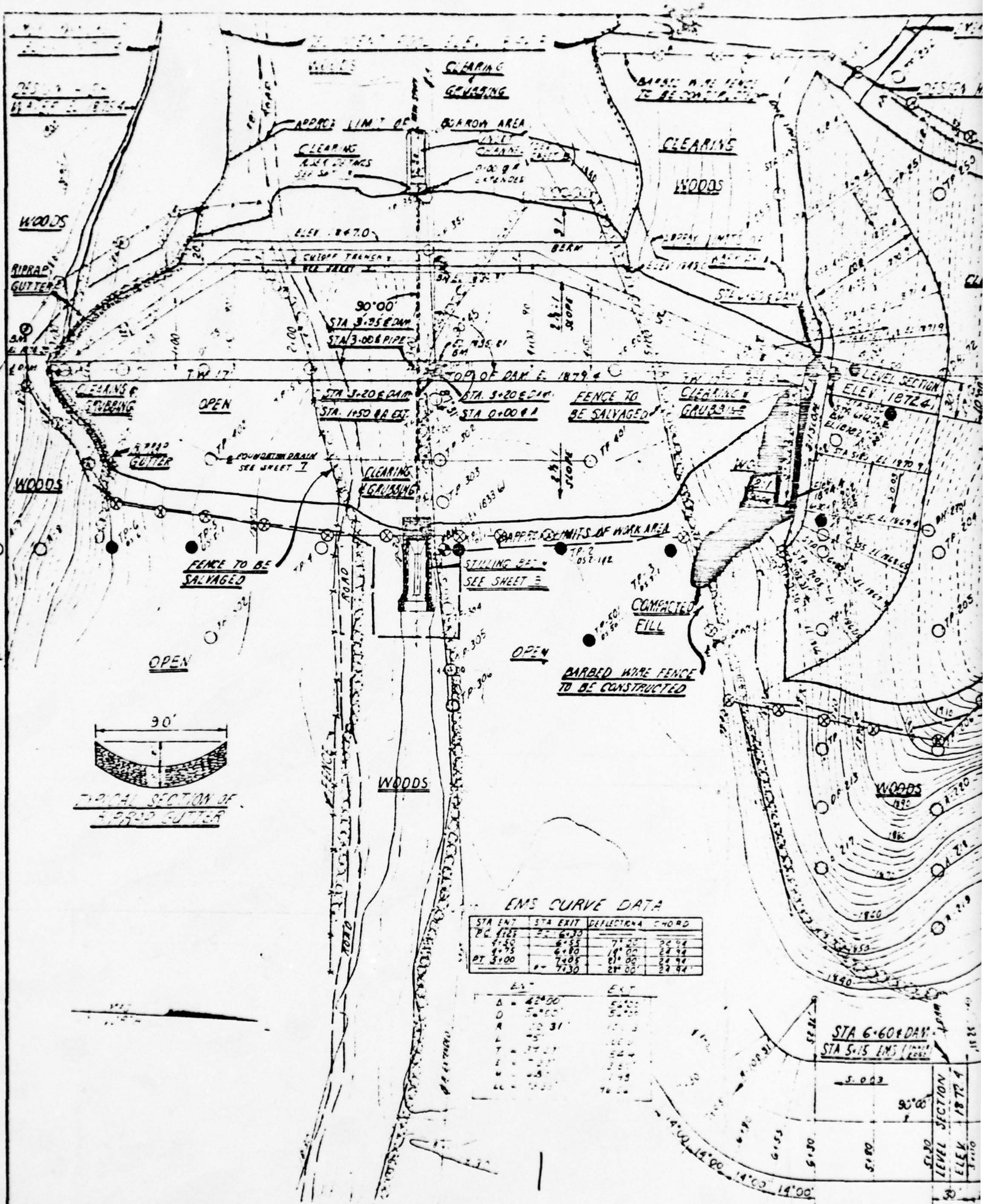
NAME OF DAM: JOHNS CREEK No. 2



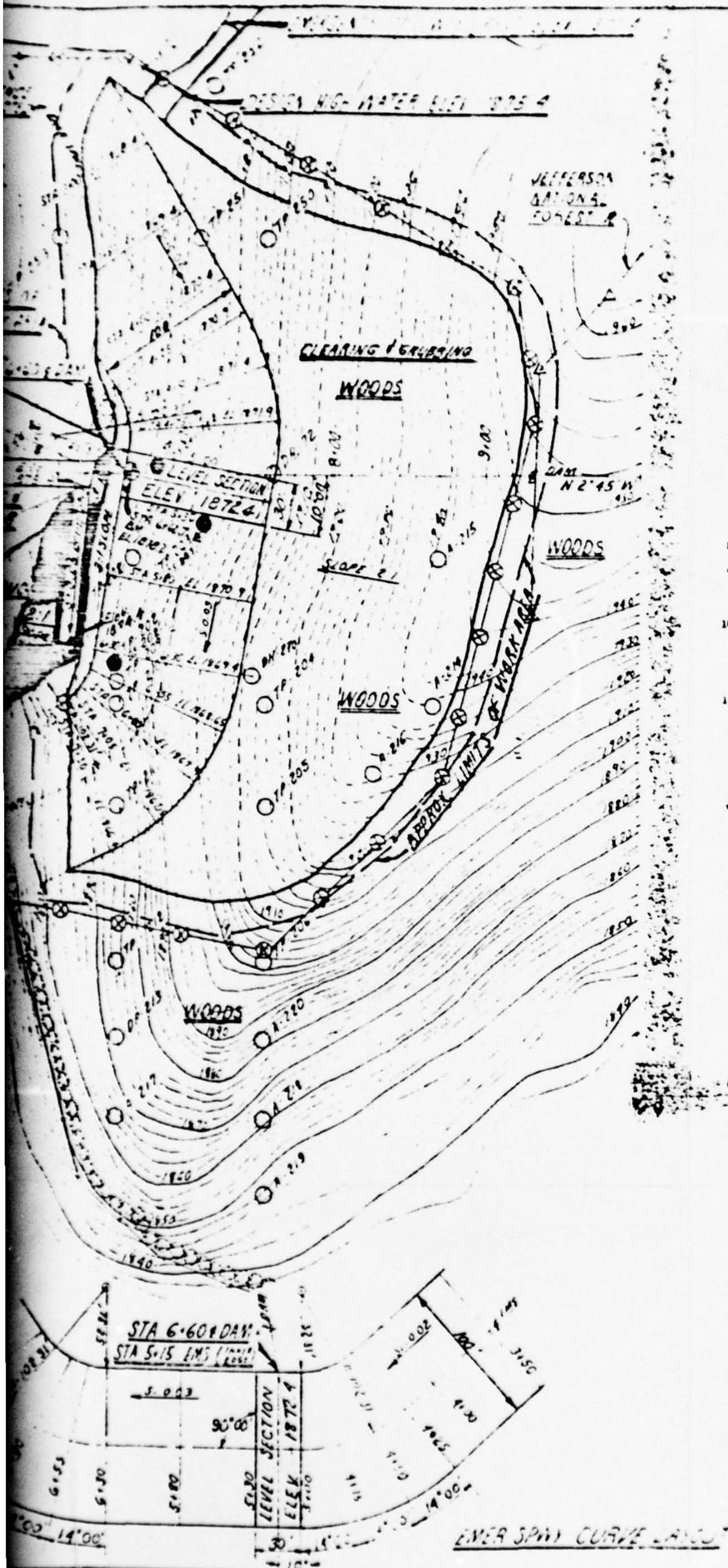
LOCATION PLAN
JOHNS CREEK DAM No. 2



FIELD SKETCH
JOHNS CREEK DAM No. 2
MICHAEL BAKER, JR., INC.
10 MAY 1979
PLATE 1



CLEARING & GRUBBING
WOODS
APPROX LIMIT OF BORROW AREA
CLEARING
CLEARING
WOODS
ELEV 1847.0
BERM
RIPRAP GUTTER
90°00'
STA 3+35 ℄ DAM
STA 3+00 ℄ PIPE
TOP OF DAM EL 1879.4
CLEARING & GRUBBING
OPEN
STA 3+20 ℄ DAM
STA 1+50 ℄ A EXT
STA 3+20 ℄ DAM
STA 0+00 ℄ A
FENCE TO BE SALVAGED
CLEARING & GRUBBING
LEVEL SECTION
ELEV 1872.4
RIPRAP GUTTER
WOODS
FOUNDATION DRAIN SEE SHEET 7
CLEARING & GRUBBING
LIMITS OF WORK AREA
FENCE TO BE SALVAGED
STILLING BASIN SEE SHEET 3
COMPACTED FILL
OPEN
OPEN
BARBED WIRE FENCE TO BE CONSTRUCTED
90'
TYPICAL SECTION OF RIPRAP GUTTER
ROAD
FENCE
WOODS
WOODS
EMS CURVE DATA
STA 6+60 ℄ DAM
STA 5+15 EMS
90°00'
LEVEL SECTION
ELEV 1872.4



GENERAL NOTES

1. Areas under dam, emergency spillway and borrow areas are to be cleared and grubbed.

2. The remaining sediment pool area is to be cleared. Clearing limits shall be:

   a. 15' (horizontal) beyond the sediment pool elevation if the slopes are equal or less than 1' vertical to 15' horizontal.

   b. 1' (vertical) above the sediment pool elevation if the slopes are steeper than 1' vertical to 15' horizontal.

3. Topsoil shall be removed from under the fill areas as directed by the Engineer.

4. Sufficient selected topsoil will be stockpiled and placed at a minimum depth of 4" on the emergency spillway side slopes as directed by the Engineer. This will be paid for as salvaging and placing topsoil.

5. The bottom of the emergency spillway is to be excavated 1' below finished grade and backfilled with compacted borrow material to be selected by the Engineer.

6. 8' excavation for borrow material is to be made within 50' of the toe of the dam.

7. The intersection of the face of the dam with the abutments is to be shaped as directed by the Engineer. Payment will be based upon the cubic yards of material used.

8. All steep slopes and rock faces shall be cut back to 1:1 slope.

9. All fences within the sediment pool area are to be salvaged. No payment will be made for salvage. It will be subsidiary to other items.

10. There are approximately 12 acres of seedbed preparation, liming, fertilizing and mulching. This includes the borrow area and embankment above the sediment pool, emergency spillway bottom and side slopes and any other disturbed areas as directed by the Engineer. This is not a part of the Contract.

11. Final location of "Fences and Gates to be Constructed" to be determined by the Engineer. Approximately 30 rods of fence, (2) 14' Gates. This is not a part of the Contract.

LEGEND

- EDGE OF WOODS

PLATE 2

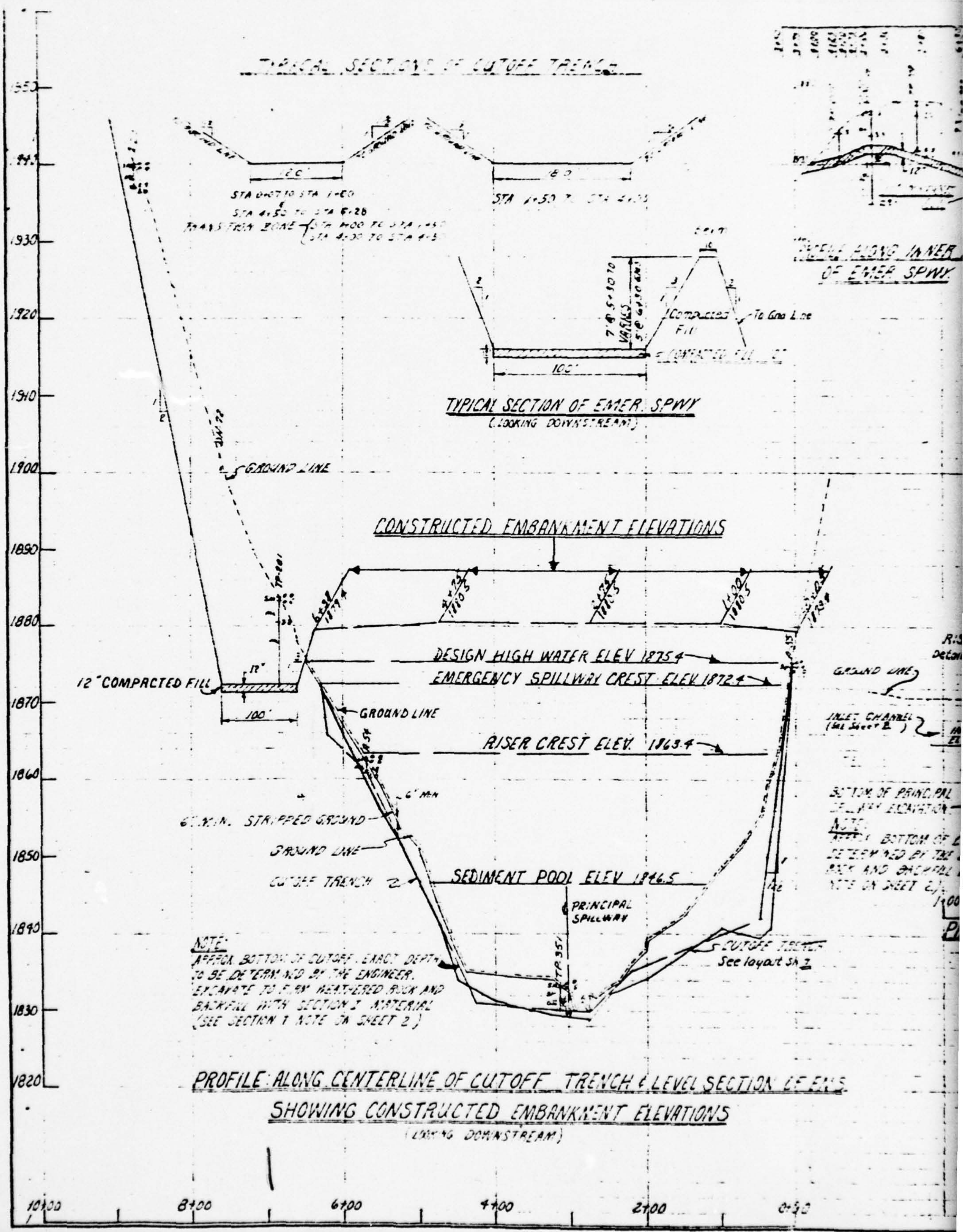
SCALE

DAM NO 2 LITTLE OREGON CREEK
JOHNS CREEK WATERSHED
PLAN OF DAM & EMERGENCY SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

VA-492-P

2



PROFILE: ALONG CENTERLINE OF CUTOFF TRENCH & LEVEL SECTION OF EMS
SHOWING CONSTRUCTED EMBANKMENT ELEVATIONS
(LOOKING DOWNSTREAM)

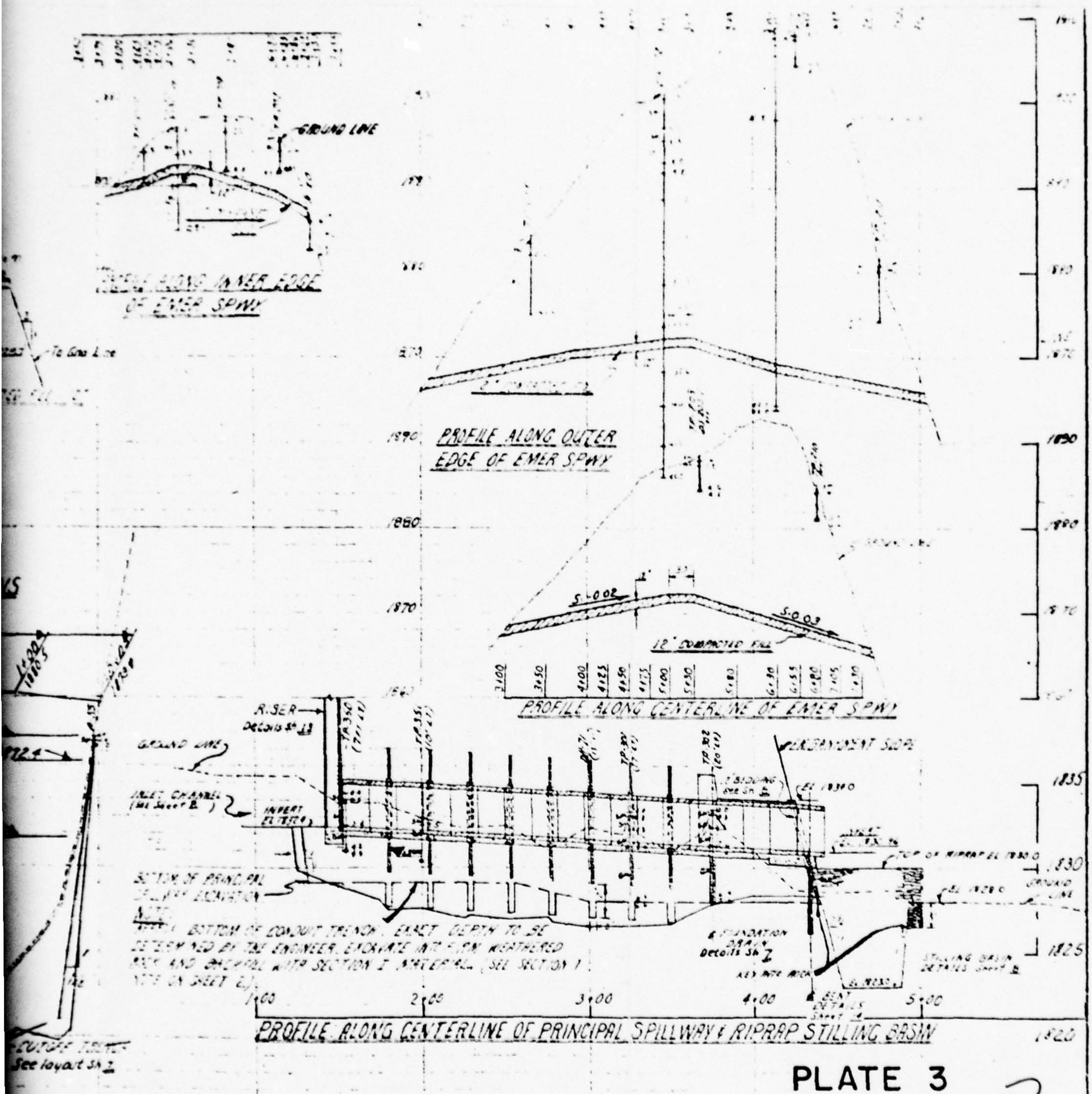
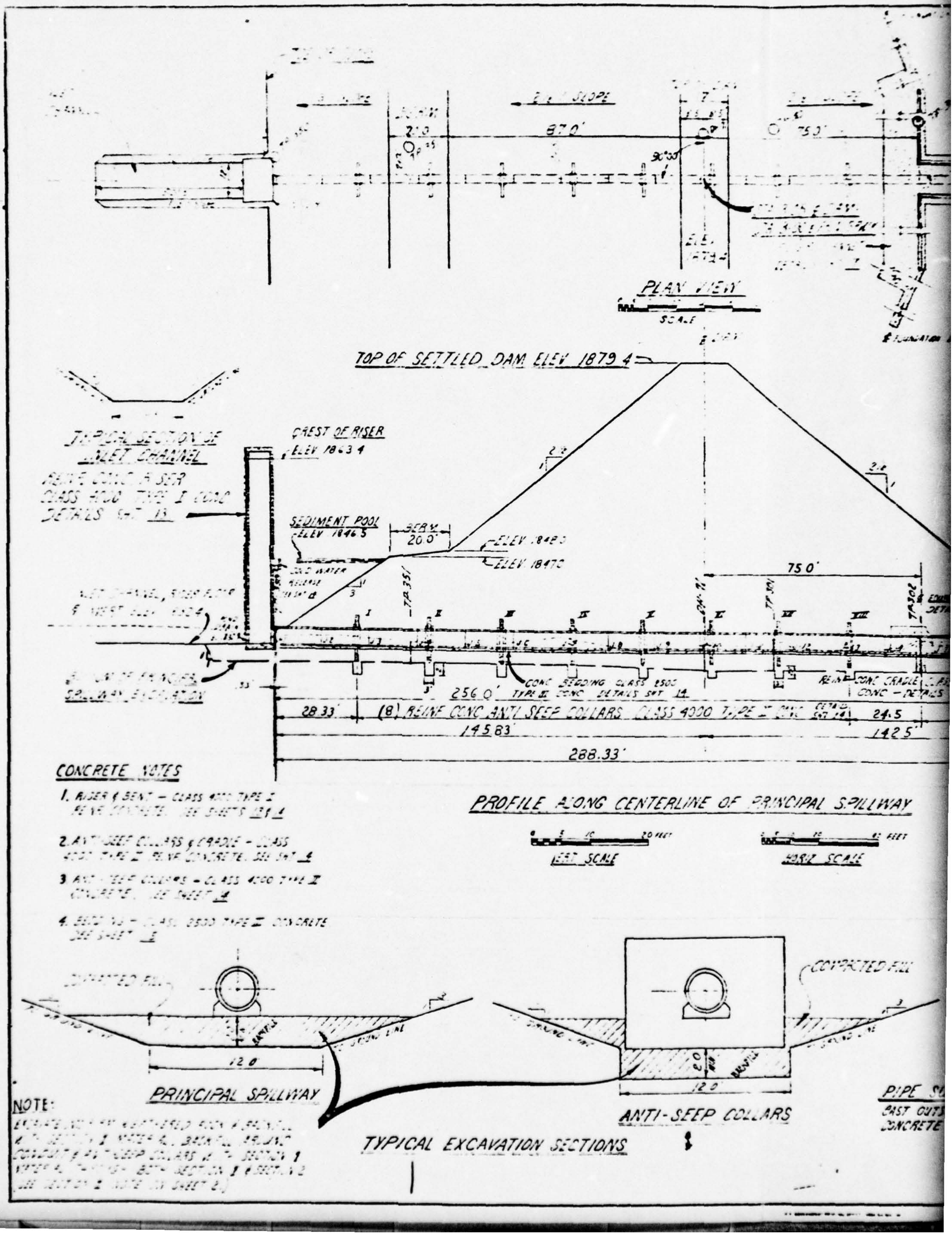
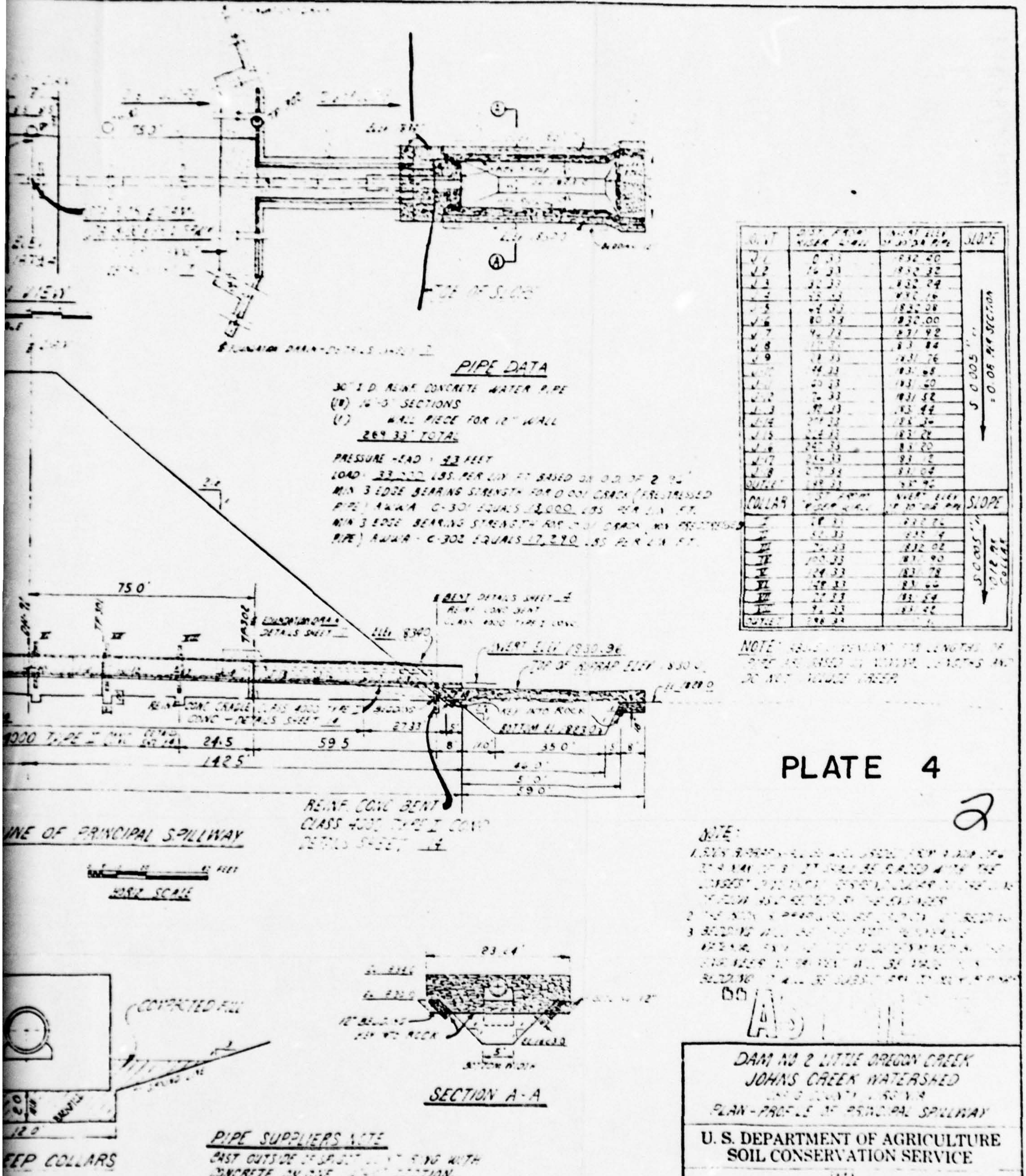


PLATE 3

2

DAM NO 2 LITTLE OREGON CREEK JOHNS CREEK WATERSHED PROFILES & TYPICAL SECTIONS
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE
L. BECK 4-5-65 · Coffman, Bolton 3-65 · VA-492-P


PLAN VIEW
SCALE
87.0'
75.0'
TOP OF SETTLED DAM ELEV. 1879.4
TYPICAL SECTION OF INLET CHANNEL
CREST OF RISER ELEV. 1863.4
REINF. CONC. RISER CLASS 4000 TYPE II CONC. DETAILS SHT. 13
SEDIMENT POOL ELEV. 1846.5
BERM 20.0'
ELEV. 1848.0
ELEV. 1847.0
75.0'
CONC. BEDDING CLASS 2500 TYPE II CONC. DETAILS SHT. 14
256.0'
28.33'
(8) REINF. CONC. ANTI SEEP COLLARS CLASS 4000 TYPE II CONC.
24.5
145.83'
142.5'
288.33'
REINF. CONC. CRADLE CONC. - DETAILS
PROFILE ALONG CENTERLINE OF PRINCIPAL SPILLWAY
VERT. SCALE
HORIZ. SCALE
CONCRETE NOTES
1. RISER & BENT - CLASS 4000 TYPE II REINF. CONCRETE. SEE SHEETS 13 & 14
2. ANTI-SEEP COLLARS & CRADLE - CLASS 4000 TYPE II REINF. CONCRETE. SEE SHT. 14
3. ANTI-SEEP COLLARS - CLASS 4000 TYPE II CONCRETE. SEE SHEET 14
4. BEDDING - CLASS 2500 TYPE II CONCRETE. SEE SHEET 14
COMPACTED FILL
12.0'
PRINCIPAL SPILLWAY
ANTI-SEEP COLLARS
TYPICAL EXCAVATION SECTIONS
NOTE:
PIPE S
CAST OUTS
CONCRETE



PIPE DATA

30" I.D. REINF. CONCRETE WATER PIPE
(II) 16'-3" SECTIONS
(I) WALL PIECE FOR 12" WALL
269.33' TOTAL

PRESSURE HEAD = 43 FEET
LOAD: 33,000 LBS. PER LIN. FT. BASED ON O.D. OF 2.96'
MIN. 3 EDGE BEARING STRENGTH FOR 0.001 CRACK (PRESTRESSED PIPE) AWWA C-301 EQUALS 12,000 LBS. PER LIN. FT.
MIN. 3 EDGE BEARING STRENGTH FOR 0.01 CRACK (NON PRESTRESSED PIPE) AWWA C-302 EQUALS 17,290 LBS. PER LIN. FT.

NOTE: ABOVE DIMENSIONS FOR LENGTHS OF PIPE ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP.

PIPE SUPPLIERS NOTE

CAST OUTSIDE OF SPIGOT JOINT RING WITH CONCRETE ON ONE 16'-3" SECTION.

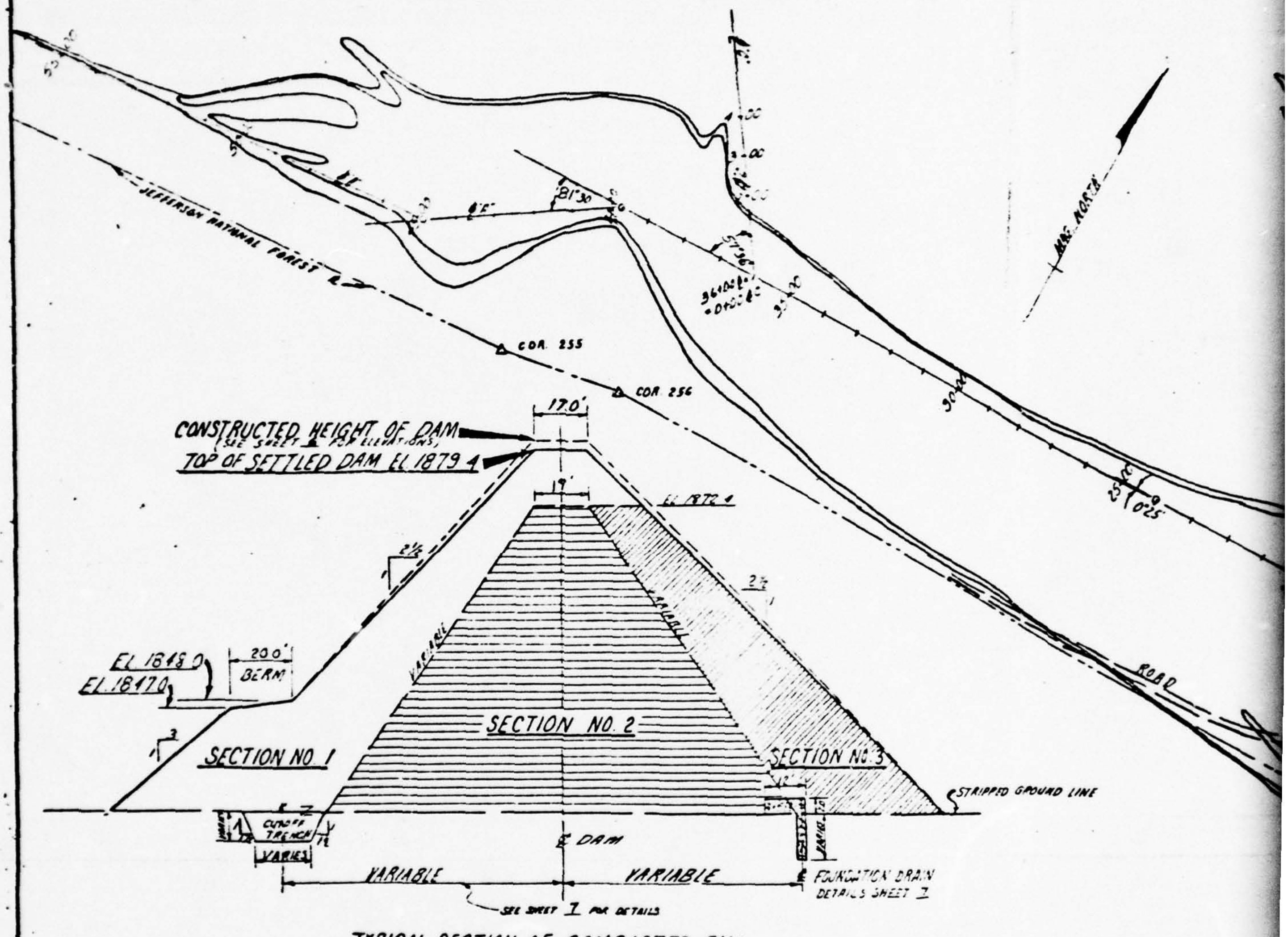
PLATE 4

2

DAM NO. 2 LITTLE OREGON CREEK
JOHNS CREEK WATERSHED
PLAN - PROFILE OF PRINCIPAL SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

14-492-P



TYPICAL SECTION OF COMPACTED FILL

SECTION NO. 1 – CUTOFF TRENCH AND UPSTREAM SLOPE, CLASS B-2 COMPACTED FILL (SPEC. 5-59)
USE ML & CL MATERIAL AS REPRESENTED BY THE LOGS OF TP-102 1'-4.6', TP-106 1'-7.8 & 7.8'-8.6', TP-113 1'-4.7', TP-130 1'-9.6', TP-201 1'-12' & TP-202 1'-1.6', PLACING MATERIAL REPRESENTED BY TP-106 IN THE CUTOFF AND LOWER PORTION OF THE SECTION

SECTION NO. 2 – CENTRAL PORTION, CLASS C COMPACTED FILL (SPEC. SA-62 & SPECIAL SPEC. FOR MOISTURE CONTROL)
SHALE AS REPRESENTED BY THE LOGS OF TP 203 1'-4'

SECTION NO. 3 DOWNSTREAM SLOPE CLASS B-2 COMPACTED FILL (SPEC. 5-59)
USE MATERIALS REPRESENTED BY THE LOGS OF TP-102 1'-4.6', TP-109 1'-3.7' & 3.7'-6.3', TP-113 1'-4.7', TP-130 1'-9.6', TP-201 1'-12' & TP-202 1'-1.6'.

NOTE: THE EMBANKMENT SIDE SLOPES SHOWN REPRESENT SETTLED SLOPES. CONSTRUCTED SLOPES WILL BE ADJUSTED AS DIRECTED BY THE ENGINEER.

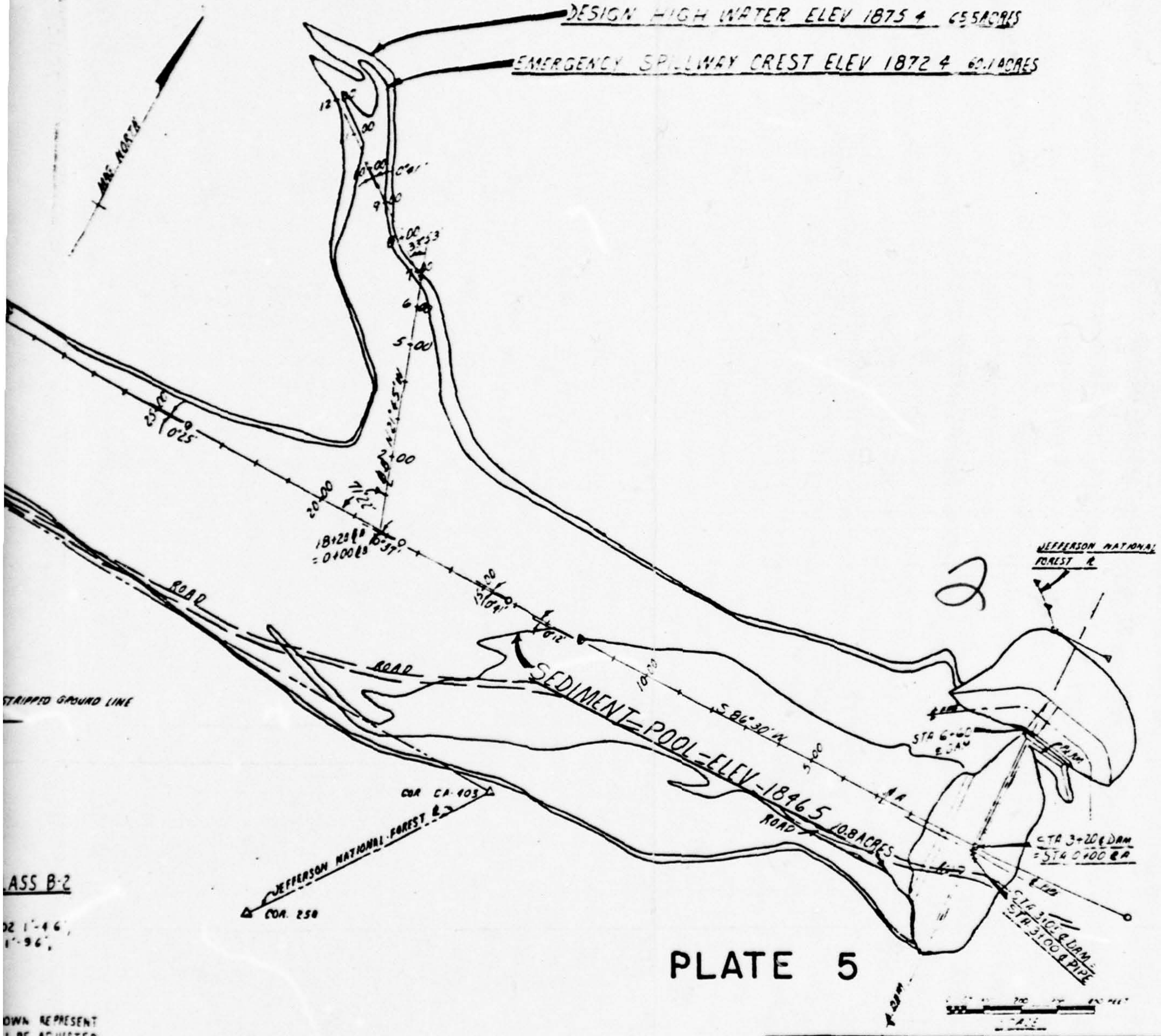


PLATE 5

DAM NO. 2 LITTLE OREGON CREEK
JOHNS CREEK WATERSHED
CRAIG COUNTY VIRGINIA
RESERVOIR AREA MAP & TYPICAL SECTION OF COMPACTED FILL

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

"AS BUILT"

Surveyed R. W. WILSON 2-65	Approved by	
W J Harlow 2/64		
Coffman, Harmon, Ward 3-65		
Coffman, Button 3-65		
L Beck 4-7-65		VA-492-P

FORM SCS-313 APRIL 1963

APPENDIX II

PHOTOGRAPHS

CONTENTS

Note: Photographs were taken on 10 May 1979.

NAME OF DAM: JOHNS CREEK No. 2

JOHNS CREEK No. 2 DAM

PHOTO 1. Debris on Junction of Upstream Embankment and Right Abutment

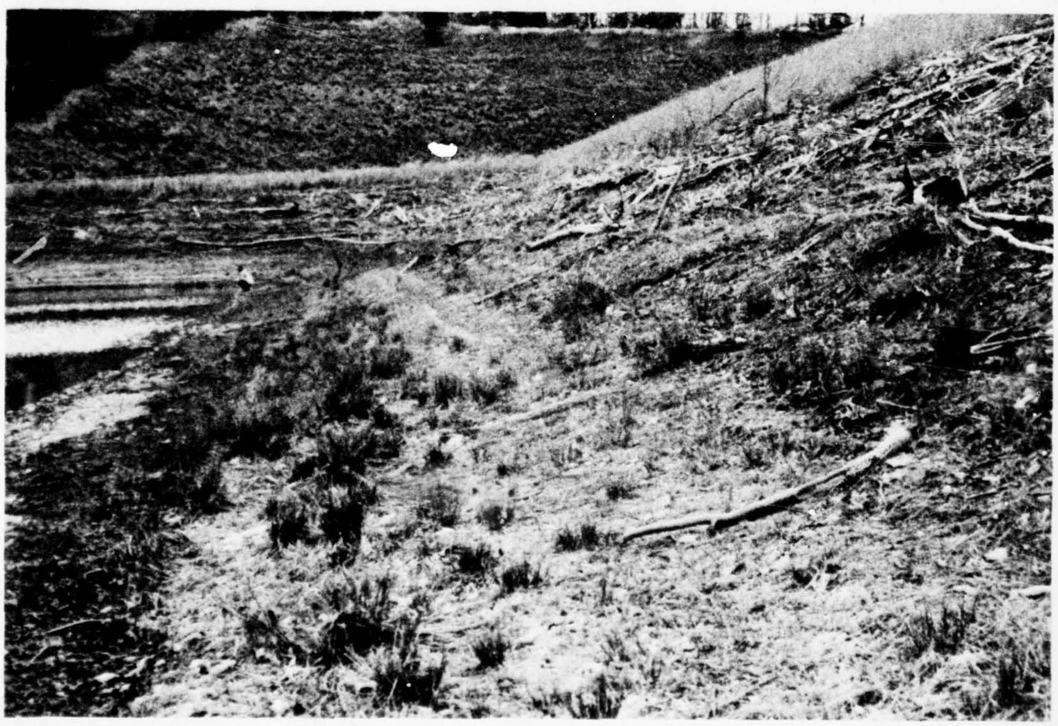


PHOTO 2. Debris and Erosion along Upstream Face of Dam

JOHNS CREEK No. 2 DAM

PHOTO 3. View of Toe of Dam Looking Toward Emergency Spillway Cut

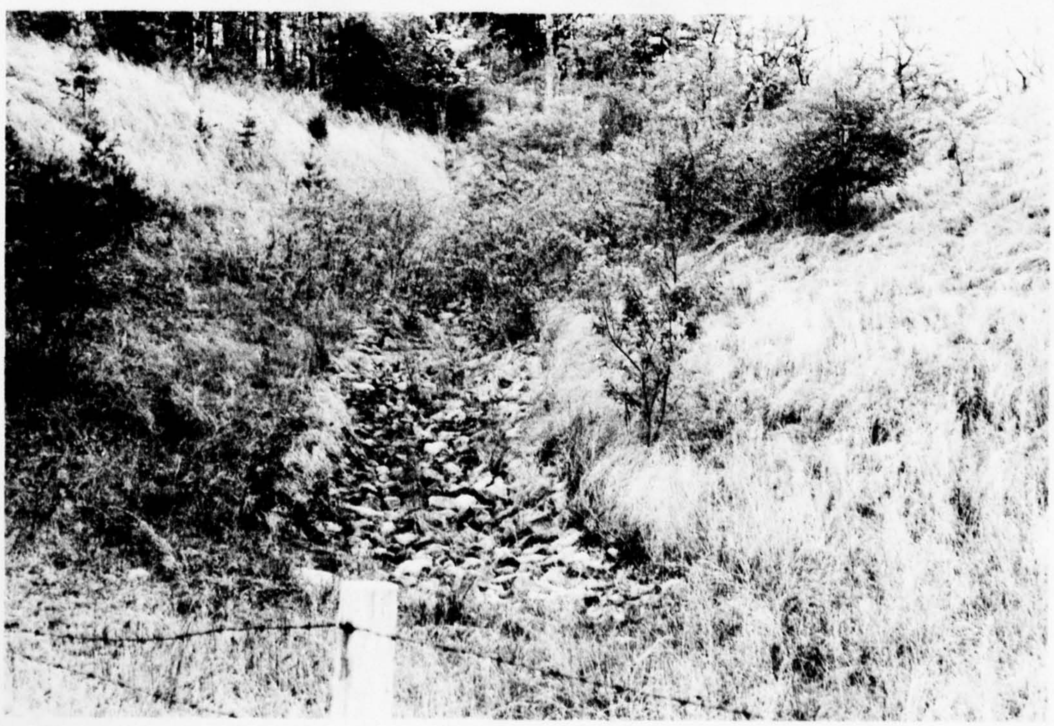


PHOTO 4. Junction of Embankment and Right Abutment

JOHNS CREEK No. 2 DAM

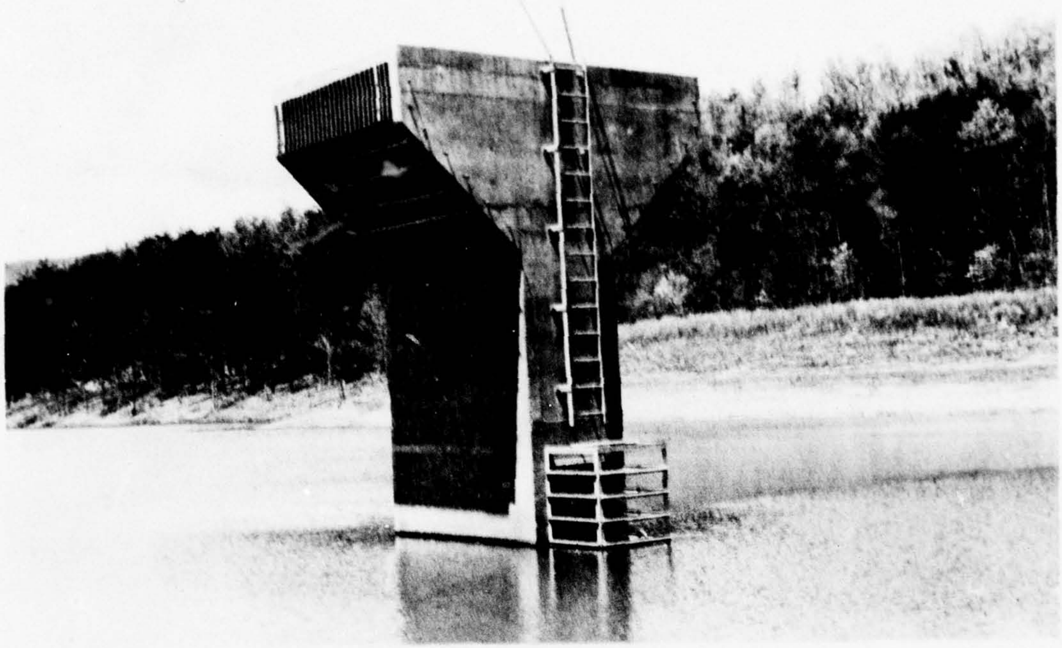


PHOTO 5. Riser, Trash Racks and Access Ladder

PHOTO 6. Outlet Pipe and Supporting Concrete Cradle

JOHNS CREEK No. 2 DAM

PHOTO 7. Stilling Basin and Riprap Protection

PHOTO 8. Erosion Behind Riprap on Right Side of Stilling Basin

JOHNS CREEK No. 2 DAM

PHOTO 9. Upstream View of Emergency Spillway

PHOTO 10. Stilling Basin and Downstream Channel Area

APPENDIX III

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase 1

Name of Dam Johns Creek No. 2 County Craig State Virginia Coordinates Lat. 3725.9

Long. 8023.3

Date of Inspection 10 May 1979 Weather Clear and hot Temperature High 80's F.

Pool Elevation at Time of Inspection 1847.2 ft. M.S.L. Tailwater at Time of Inspection 1828.6 ft. M.S.L.

Inspection Personnel:

Michael Baker, Jr., Inc.:
T. W. Smith
D. Johns
B. M. Camlin

Virginia Water Control Board:
Hugh Gildea

B. M. Camlin Recorder

EMBANKMENT

Name of Dam: JOHNS CREEK No. 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The vertical and horizontal alignment of the crest coincides with the as-built drawings.	
RIPRAP FAILURES	The riprap in the gutters is in good condition with some brush growth. The lower part of the left upstream gutter is covered with debris.	

EMBANKMENT

Name of Dam: JOHNS CREEK No. 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	There are numerous small trees on both the upstream and downstream embankment faces. Sericea growth is well developed and provides adequate protection.	All trees should be removed.
RODENT HOLES	There are several rodent holes in the lower portion of the downstream embankment located above the outlet pipe.	All rodents should be removed and the burrows filled.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Junctions are in good condition except for small amounts of briars growing in portions of the rock-lined ditches on the right side. On the upstream side of the right abutment there is a large accumulation of debris, which is mainly logs and brush.	
ANY NOTICEABLE SEEPAGE	A small immeasurable amount of seepage is occurring on the downstream side, particularly on the right, beginning at the lower end of the riprap-lined ditch. Because water elevation was at normal pool, there was no significant head.	
STAFF GAGE AND RECORDER	None observed	A staff gage should be installed to monitor reservoir levels above normal pool.
DRAINS	Flow from right toe drain outlet pipe (6 in. B.C.C.M.P.) is estimated at $\pm$ 1 g.p.m. There is no flow from the left drain. There is some iron staining of the riprap below the outlets.	

OUTLET WORKS

Name of Dam: JOHNS CREEK No. 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No cracking or spalling was observed. Concrete cradle is well supported by the existing ground.	
INTAKE STRUCTURE	Concrete on the exterior surfaces of the intake structure is in good condition and no spalling or cracking was observed. Trash racks are in good condition and clear of debris.	
OUTLET STRUCTURE	The outlet structure consists of a precast 30 in. I.D. R.C.P. emptying into a riprap-lined stilling basin approximately 50 ft. long and 23 ft. wide. Although the stilling basin is functioning properly, the riprap is in need of repair, particularly on the right side where the riprap is collapsed and erosion has occurred to the adjacent slope.	Repair defective riprap and replace eroded area with rock.
OUTLET CHANNEL	The channel downstream of the stilling basin is well-defined and clear of debris.	
EMERGENCY GATE	The reservoir may be drained by means of a 24 in. diameter slide gate located on the upstream side of riser with an invert elevation of 1832.9 ft. M.S.L.	

UNGATED SPILLWAY

Name of Dam: JOHNS CREEK No. 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTION	The level section of the emergency spillway is 100 ft. wide and 30 ft. long with a crest elevation of 1872.4 ft.	
APPROACH CHANNEL	The approach channel has a good cover of vegetation and a 2% adverse slope.	
DISCHARGE CHANNEL	The discharge channel has a 3% slope and discharges outside the left abutment. The channel is well vegetated.	
BRIDGE AND PIERS	Not Applicable	

INSTRUMENTATION

Name of Dam: JOHNS CREEK No. 2

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	Bench marks noted on as-built drawings were not located in field.	
OBSERVATION WELLS	None observed	
WEIRS	None observed	
PIEZOMETERS	None observed	
OTHER		

RESERVOIR

Name of Dam: JOHNS CREEK No. 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate slopes around reservoir are heavily wooded and appear stable; there are several rock outcrops on the left side. On the left side, there is a significant amount of dead fallen trees.	The dead trees should be removed to prevent further accumulation of debris.
SEDIMENTATION	No serious sedimentation was noted during the field inspection which would inhibit proper operation of the dam and reservoir.	

DOWNSTREAM CHANNEL

Name of Dam: JOHNS CREEK No. 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The channel meanders through an open pasture field and is in good condition with no obstructions or debris.	
SLOPES	The slope of the downstream channel is about 1% with approximately 1.5:1 side slopes.	
APPROXIMATE NO. OF HOMES AND POPULATION	No inhabited houses were observed within the first mile downstream of the dam. Several houses located beyond the first mile are generally at high enough elevations to not be seriously affected by high water.	

APPENDIX IV

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: JOHNS CREEK No. 2

ITEM	REMARKS
PLAN OF DAM	The Plan of Dam is shown on the as-built drawings and is included in this report as Plate 2.
REGIONAL VICINITY MAP	The vicinity map is presented in this report as the Location Plan.
CONSTRUCTION HISTORY	The contractor and completion date were obtained from the COE. The dam was constructed by Branch and Assoc., Inc. in 1967.
TYPICAL SECTIONS OF DAM	Typical sections are included in the as-built drawings and are presented in this report as Plates 3, 4 and 5.
HYDROLOGIC/HYDRAULIC DATA	Hydrologic and hydraulic calculations were available.
OUTLETS - PLAN and DETAILS	Shown on the as-built drawings.
- CONSTRAINTS and DISCHARGE RATINGS	Contained in the hydrologic/hydraulic calculations.
RAINFALL/RESERVOIR RECORDS	No rainfall or reservoir records are available at the dam.

Name of Dam: JOHNS CREEK No. 2

ITEM	REMARKS
DESIGN REPORTS	Design Reports were obtained from the SCS.
GEOLOGY REPORTS	Data on detailed geologic investigations is contained in the Design Report and included in Appendix VII. Pages 5 and 6 of the geology report were not provided for review.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Hydrology and hydraulic calculations were available for this inspection report. Stability analyses were available for this inspection report and are included in Appendix VI. This information is incomplete; Sheets 2 and 4 of the Summary-Slope Stability Analysis, accompanying the 15 December 1964 memorandum, and Sheet 6 accompanying the 20 January 1965 memorandum, were not provided for review.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Test pit and boring records, resistivity data compaction curves and results of laboratory analyses were printed in the as-built drawings and/or in the Detailed Geologic Report.
POST-CONSTRUCTION SURVEYS OF DAM	No known post-construction surveys were found.
BORROW SOURCES	Borrow source in the reservoir area is shown on the as-built drawings.

Name of Dam: JOHNS CREEK No. 2

ITEM	REMARKS
MONITORING SYSTEMS	No monitoring systems have been provided.
MODIFICATIONS	Data obtained during the inspection agrees closely with the as-built drawings, indicating that no major modifications were made.
HIGH POOL RECORDS	None available
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	No prior accidents or failure of the dam have been noted.
MAINTENANCE OPERATION RECORDS	Annual inspections are conducted by the Natural Bridge Soil and Water Conservation District. Copies of the reports are included in Appendix V.

Name of Dam: JOHNS CREEK No. 2

ITEM	REMARKS
SPILLWAY PLAN, SECTIONS and DETAILS	Information contained in the as-built drawings.
OPERATING EQUIPMENT PLANS & DETAILS	Information contained in the as-built drawings.

APPENDIX V

OPERATION AND MAINTENANCE INSPECTION REPORTS

COMMONWEALTH OF VIRGINIA

NATURAL BRIDGE SOIL AND WATER CONSERVATION DISTRICT

May 25, 1979

Route 1, Box 274
Daleville, VA 24083

Thomas W. Smith
Michael Baker, Jr. Inc.
Engineers and Surveyors
4301 Dutch Ridge Road
Box 280
Beaver, Pennsylvania 15009

Dear Mr. Smith:

Enclosed are copies of the last five(5) years operation and maintenance inspection reports of the dams on Johns Creek Watershed. These are the reports you requested by letter dated May 17, 1979.

We would like to receive a copy of your inspection report for our information and files.

Sincerely,

Jack W. Bostic (eas)

Jack W. Bostic, Chairman

Enclosures

w/s

P. O. Box 56
Fincastle, Va. 24090

June 9, 1978

David N. Grimwood
State Conservationist
Soil Conservation Service
P. O. Box 10026
Richmond, Va. 23240

Subject: NBSWCD Annual O&M Report (1978) Johns Creek Watershed

Dear Mr. Grimwood,

District Director J. Francis Ross and myself along with D. A. Towler, District Conservationist made the annual operation and maintenance inspection of the Johns Creek Watershed project on June 6, 1978.

All structures (Nos. 1,2,3 and 4) were found to be in a safe and satisfactory operating condition. The water levels were at their normal levels. The concrete risers and principal spillways along with the metal trash racks and ladders were found to be in good condition.

The vegetative cover on all dams was in good condition, Dam No. 3 was being grazed and at present the grazing was at an acceptable level.

Considerable debris has accumulated along the face of Dam #2 and needs to be removed.

The repair work has been completed by the district to the gully in the access road leading to the Emergency Spillway on Dam #2 (this item mentioned in the 1977 O&M report).

Conservation plans have been developed during the present calendar year to cover Dams #2 and 3. These conservation plans with the land user will be used as the basis for normal maintenance of these areas.

P. D. Hughston
Chairman, Natural Bridge SWCD

D. A. Towler
District Conservationist

cc: J. M. Betts w/enclosures

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Rt. 1 Box 274
Daleville, Va. 24083

SUBJECT: W/S - Johns Creek Watershed
Annual Operation and Maintenance Inspection

DATE: June 2, 1977

TO: J. M. Betts
Area Conservationist
Harrisonburg, Va.

This is a report of subject inspection of Dams 1, 2, 3 and 4 made jointly by the Natural Bridge SWCD Director Francis Ross and SCS District Conservationist D. A. Towler on May 24, 1977.

In general all four dams were found to be in very good condition. A small amount of debris was found deposited along the high water lines from a heavy rain in early spring. This debris is lightly scattered and no problems are anticipated.

The low stage orifice on Dam #2 has a small amount of debris in the opening. The present lessor of the lake will be contacted by the NBSWCD to remove this obstruction. The access road to the RMS on Dam #2 is eroding beside the stone that the NBSWCD used in 1976 to fill a similar small gully. The NBSWCD will contact a contractor to discuss arrangements on repairing this gully.

Francis Ross
Natural Bridge SWCD Director

D A Towler

D. A. Towler
SCS District Conservationist

Water Resource Committee Mbr
D. Towler

COMMONWEALTH OF VIRGINIA

NATURAL BRIDGE SOIL AND WATER CONSERVATION DISTRICT
P. O. BOX 56, FINCASTLE, VIRGINIA 24090

June 23, 1976

David N. Grimwood
State Conservationist
Soil Conservation Service
P. O. Box 10026
Richmond, Virginia 23240

SUBJECT: NBSWCD Annual O & M Inspection Report 1976, Johns Creek Watershed Project

Dear Mr. Grimwood:

District Director J. F. Ross and myself, accompanied by Huey Kelly and W. B. Garrett (local SCS technicians) made the NBSWCD annual inspection of the completed portion (floodwater retarding structures Nos. 1, 2, 3, and 4) of the Johns Creek Watershed Project June 11.

All structures appeared to be safe and operating satisfactorily.

Specific Findings:

Dam #1 - Overall appearance - good; vegetative cover - 98% sericea (ungrazed and unmowed); fertilizing needed in part of emergency spillway to rejuvinate thin area; berm and portion of dam adjacent to normal pool level mostly bare, needs to be established in a water tolerant cover such as Reed' Canary grass -; riser openings clear; small amount of debris on face of dam, small trees adjacent to loose rock gutters at end of dam need removing.

Dam #2 - Overall appearance - good. Vegetative cover same as #1, (the Natural Bridge District had repaired the gully mentioned in it's 1975 O & M report); there was some debris around 1st stage riser intake and considerably more on face of dam and south bank of the permanent pool. Bare car tracks evidenced too much travel through the emergency spillway; (the district has initiated steps to control this).

Dam #3 - Overall appearance - good; vegetative cover same as #1.

Dam #4 - Overall appearance - good; vegetative cover same as for #1. Change in 1st stage opening made by SCS last fall appears to have corrected the too slow draw down problem.

No major flooding conditions took place in the watershed during the past year.

The NBSWCD expresses appreciation to the USDA - SCS for work performed as needed to correct the 1st stage opening of riser at the No. 4 dam.

Sincerely,

P. D. Hughston

P. D. Hughston
Chairman, NBSWCD District

December 16, 1975

David N. Grimwood
State Conservationist
Soil Conservation Service
P. O. Box 10026
Richmond, Va. 23240

SUBJECT: NBSWCD Annual O&M Report (1975) Johns Creek Watershed

Dear Mr. Grimwood:

District Director J. F. Ross and myself made the NBSWCD annual inspection of the completed portion (floodwater retarding structures Nos. 1,2,3 and 4) of the Johns Creek Watershed Project on August 19, 1975.

All structures were found to be in substantially safe and satisfactory operating condition with the following exceptions:

Structure No. 4 - Due to the relatively small size of the first stage opening in the riser, moderately wet periods result in waters standing over much of the "designed" temporary storage area too long and no vegetative cover could be maintained on these lands. This condition also lowered the flash flood storage potential considerably. (District Conservationist Dwight Towler, USDA, SCS informed our directors in November that the SCS had completed work on the riser designed to correct this situation.)

Structure No. 2 - An active gully 1 to 2 feet in depth 200+ feet long was cutting into the steep access area leading from the emergency spillway. While not presently affecting the structures operations, if left unstabilized, this gully could develop into a serious source of erosion and sediment.

The District is currently considering alternatives for correcting this problem but no final decision has been made.to date.

The protection given by these dams during the past years intensive rains on Johns Creek was appreciatively noted by many people living in that valley.

Yours very truly,

P. D. Hughston

P. D. Hughston
Chairman Board of Directors

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE - P. O. Box 47, Fincastle, Va. 24090

SUBJECT WS - Johns Creek Watershed
Annual Maintenance Inspection

DATE Jan. 10, 1975

TO Wm. D. Richardson
Area Conservationist
Soil Conservation Service
Route 1, Box 274
Daleville, Virginia 24083

This is a report of the annual maintenance inspection on Johns Creek Watershed Dams 1, 2, 3, and 4. This inspection was made jointly by Natural Bridge SWCD Director Jack Larkins, SCS District Conservationist D. A. Towler, and SCS Technician W. B. Garrett on January 9, 1975.

In general all four dams were found to be in very good condition. Some erosion is occuring on the area below the EMS on Site #2 which was damaged and subsequently repaired following the May 28, 1973 storm.

No progress has been made in obtaining a contractor to make the planned alterations to the low stage orifice on Dam #4.

Jack Larkins
Natural Bridge SWCD Director

D. A. Towler
SCS District Conservationist

APPENDIX VI

STABILITY ANALYSES

DPL File Cop.

UNITED STATES GOVERNMENT

Memorandum

TO : R. C. Barnes, State Conservation Engineer, SCS, Richmond, Virginia 23240

DATE: December 15, 196-

FROM : Rey S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska 68508

SUBJECT: ENG - Soil Tests 22 - Virginia WP-08, Little Oregon Creek, Johns Creek, Site No. 2 (Craig County)

ATTACHMENTS

1. Form SCS-354, Soil Mechanics Laboratory Data, 4 sheets.
2. Form SCS-355, Triaxial Shear Test Data, 6 sheets.
3. Form SCS-352, Compaction and Penetration Resistance Report, 10 sheets.
4. Form SCS-357, Summary - Slope Stability Analysis, 8 sheets.
5. Form SCS-372, Recommended Use of Excavated Material, 1 sheet.

DISCUSSION

GENERAL

Two ¢ locations were investigated. Foundation samples were submitted to the laboratory from Location "A" which is 150 ft. downstream from Location "B". The discussion that follows deals primarily with Location "A".

FOUNDATION

A. Classification: Bedrock at this site is black fissile shale of the Millboro formation. Resistivity surveys were made. These surveys indicate that the bedrock is weathered to depths of 6 ft. to 8 ft., slightly weathered to depths of 15 ft. to 20 ft. and unweathered at greater depths.

In general, soils covering bedrock on both abutments are less than 4 ft. thick. The bedrock is exposed in the channel. The alluvial terrace soils which consist of clays, silts, sands and gravels are from 4 ft. to 6 ft. thick. Colluvial terrace soils near the right abutment are 13 ft. thick. Sample No. 65W561 (1.1) represents the gravels found along the left channel bank. Sample Nos. 65W562 (2.1), 65W563 (2.2), and 65W565 (5.1) are CL and ML. Sample Nos. 65W564 (3.1) and 65W566 (6.1) represent the colluvium which is ML and CL bordering the ML classification. Sample No. 65W567 (501.1) is a sandy CL.

B. Density: Specimens tested when the core samples were opened had dry unit weights of 1.43 gm/cc, 89.3 p.c.f., and 1.31 gm/cc, 81.8 p.c.f. Density of shear specimens from sample No. 65W565 was 1.31 gm/cc, 81.3 p.c.f., and 1.51 gm/cc, 94.5 p.c.f. Obviously the two sets of specimens came from different lifts in the core.

Tests were made in the field. Densities of 94.0 p.c.f. to 99.0 p.c.f. were obtained for the alluvium and densities of the terrace materials on both abutments ranged from 98.5 p.c.f. to 103.0 p.c.f.

C. Consolidation: Considering the relatively shallow depth to bedrock, it was decided that consolidation tests were not needed. Six percent consolidation is assumed for the silty and clayey soils on the basis of classification and density. Estimated total consolidation at ℄ Station 5+25 is 0.3 ft.

The conduit can be placed on bedrock. Therefore, horizontal strain should not be a problem.

D. Permeability: The terrace and alluvial terrace soils are described as being slowly permeable. The gradation of these CL and ML materials and the difficulty encountered in saturating shear test specimens bear this out. The field permeability tests show that rates vary from 0 to 4 ft./day. It is assumed that the higher rates are due to gravel strata or the weathered bedrock surface.

E. Shear Strength: A triaxial test was made on sample No. 65W565. Results were not consistent due in part to variations in dry density and moisture content. Refer to Form SCS-355.

The triaxial test on sample No. 65W563 resulted in shear values of $\phi = 24.5°$, c = 100 p.s.f. The moisture content of specimens was low, about 80% of theoretical saturation. A set of specimens was cut for direct shear with the hope that saturation would be achieved by flooding. Shear values from this test are $\phi = 25°$, c = 1200 p.s.f. Test specimens had dry densities ranging from 1.62 to 1.68 gm/cc.

EMBANKMENT

A. Classification: Available materials include CL, ML, SC, SC-SM and shale. Approximately 60,000 cu. yds. of shale will be taken from the emergency spillway area for ℄ Location "A", downstream location. More of the Allen series soil is available at the upstream location.

B. Density: Standard Proctor density tests were made. Maximum density of the CL and ML soils (minus No. 4 fraction) ranges from 100.5 to 107.5 p.c.f. Maximum density of the sands is 113.5 p.c.f. for the SC-SM, 65W574, and 117.5 p.c.f. for the SC, 65W575.

Two tests were made on the shale. Maximum density (standard) of the minus No. 4 fraction is 114.5 p.c.f. The "breakdown" test is a one-point test at natural moisture on a sample graded as shown on Form SCS-354. Modified effort is used. The mass density was 122.0 p.c.f. with the breakdown gradation shown on Form SCS-354.

C. Shear Strength: Sample No. 65W557, ML, was tested. Consolidated, undrained shear values are ϕ = 29°, c = 425 p.s.f. for material compacted to 95% of standard density. This is comparable to the values obtained for sample No. 65W746, ML - Site No. 3 (ϕ = 24.5°, c = 550 p.s.f.) - and for the mix of sample No. 64W3550 and 64W3552, SC-SM - Site No. 1 (ϕ = 24°, c = 400 p.s.f.).

Two tests were made for the shale starting with material having 66% larger than No. 4. Effective stress values are ϕ = 39.5°, c = 850 p.s.f. with a dry density of 126 p.c.f. and ϕ = 39°, c = 450 p.s.f. with a dry density of 120 p.s.f. The percent passing No. 4 increased from 34% to 52% for the 126 p.c.f. test and from 34% to 42% for the 120 p.c.f. test. It appears that the lower density is practical.

SLOPE STABILITY ANALYSIS

A modification of the Swedish circle method is used to check 2 1/2:1 over 3:1 upstream and 2 1/2:1 downstream slopes. It is assumed that the phreatic line is controlled by drainage.

Refer to Form SCS-357.

Sheet Nos. 1 and 2: The maximum cross-section (channel) is treated. Embankment zoning is based on the estimated quantities of material assuming that all the shale is used. Note that shear values of ϕ = 24.5°, c = 400 p.s.f. are used in the downstream embankment section. These are from the SC-SM, sample Nos. 64W3550 and 64W3552 of Site No. 1. Factors of safety indicate that slope modifications are not needed.

Sheet Nos. 3 and 4: This is a floodplain cross-section taken at ℄ Station 2+15. The zoned embankment and a 6-ft. deep foundation are considered, using foundation shear strength values from sample No. 65W565. These two trials indicate that modifications are not necessary.

Sheet Nos. 5 and 6: Here, the zoned embankment is considered over a 6-foot deep foundation with strength of ϕ = 24.5°, c = 100 p.s.f. as obtained for sample No. 65W563. These trials indicate that a 20-ft.

berm is needed on the upstream slope for a factor of safety in the range of 1.5 (1.5 is suggested for the drawdown case because effective stress parameters are used in the embankment). The 2 1/2:1, drained, downstream slope is satisfactory.

Sheet Nos. 7 and 8: This analysis considers a homogeneous embankment of CL and ML soils over a 6-ft. deep foundation with shear values of $\phi = 24.5°$, c = 100 p.s.f. It was indicated that more of the Allen series soils would be available at ℄ of dam Location "B", upstream. Embankment shear values are taken from sample No. 65W746, Site No. 3. These trials show that a 20-ft. berm is needed on the upstream slope. A factor of safety in the range of 1.35 is acceptable, here, because total stress shear values are used.

CONCLUSIONS AND RECOMMENDATIONS

A. Cutoff and Drainage: There is some question regarding the relative permeabilities of the floodplain soils and the underlying weathered bedrock. The following alternates are not set down as definite recommendations but should be helpful in assessing the problem.

1. Assuming that the weathered shale is impermeable, cut off the soils to bedrock and use a relatively shallow drain for control of the phreatic line.

2. Assuming that positive cutoff cannot be made, cut off disturbed surface material and install a trench drain with the drain bottom on bedrock.

It is suggested that the cutoff be placed under the upstream core section which will contain CL material as shown in the sketch on Form SCS-372.

It appears that a fine concrete aggregate can be used for the drain. It is recommended that the drain be wide at the top, 12 ft. to 15 ft., to contact the shale and the downstream shell material. Refer to the sketch on Form SCS-372.

B. Principal Spillway: At the ℄ Station 4+40 location, the conduit trench would bottom in coarse material. The drain should encompass the conduit to assure interception of seepage from along the conduit.

Another possible location is ℄ Station 3+25 where the trench would be in finer grained soil and the conduit could be bedded on shale.

Rey S. Decker

Subj: ENG - Soil Tests 22 - Virginia WP-08, Little Oregon Creek, Johns Creek, Site No. 2 (Craig County)

The ratio of base width to foundation soil depth is high. Therefore, maximum horizontal strain is not significant.

C. Embankment Design:

1. [illegible] A zoned embankment is recommended, placing shale in the center section. The CL and ML upstream section will serve as a low permeability blanket. It is suggested that the SC and SC-SM be placed in the downstream section. Shear strength of these sands is somewhat less than that of the ML.

   The recommended density control for the sands and fine grained soil is 95% of standard.

   The shear strength of the shale was determined for a mass density of 120.0 p.c.f. with approximately 65% rock. We suspect that the shear strength for a mass density of 120 p.c.f. with less rock, say 35% to 40%, may be less than obtained as tested. To facilitate compaction control on the embankment, an additional test should be made with a mass density of 120 p.c.f. and 35% rock. The control specification could then be based on a minimum mass density regardless of the amount of rock. We can use this information for correlation on other shales so this test will not be charged to this site.

2. Slopes. A 2 1/2:1 over 3:1 upstream slope with a 20-ft. berm is recommended. The berm elevation is 1847.5. A 2 1/2:1 downstream slope is recommended.

3. Settlement Allowance. The suggested settlement allowance is 1.3 ft.; 0.2 ft. for the foundation and 1.1 ft. or 2.5% for the embankment.

NOTE: Recommendations for the upstream location, B, are the same as those for the downstream location, A.

Prepared by:

Robert E. Nelson

Reviewed and Approved by:

Roland B. Phillips

Attachments

cc: R. C. Barnes (5)
H. M. Kautz, Upper Darby, Pa.
G. W. Gribb, Upper Darby, Pa.

[illegible]

FORM SCS-357
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

Sheet 1 of 3

Maximum Section

SUMMARY - SLOPE STABILITY ANALYSIS

State *Virginia* Project *John's Creek Site #2*

Date *11-13-[illegible]* Analysis Made By *A.W.L.* Checked By *T.[illegible]*

Method of Analysis *Swedish Circle*

	From site #1						*From Site #3*			
Location of Material	*Found*		*Emb*		*Emb.*		*Emb*		*Emb*	
			95% Std		*122 BCE*		*95% Std*		*95% Std*	
	ML		*SC-SM*		*Shale*		*ML*		*ML*	
Sample No.	*65W565*		*[illegible]452*		*65W570*		*65W74[illegible]*		*65W577*	
γ_d	*97.9*		*110.3*		*122.0*		*94.9*		*93.4*	
γ_m			*127.5*		*132.0*		*116.5*		*119.2*	
γ_s	*112.0*		*131.5*		*13[illegible].0*		*122.0*		*123.5*	
γ_b	*49.5*		*69.0*		*73.5*		*59.5*		*61.0*	
Condition	~~Opt.~~ *Sat.*	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ	*2[illegible]°*	*35.5°*		*24.0°*		*39.0°*		*24.5°*		*29.0°*
Tan ϕ	*0.433*	*0.714*		*0.445*		*0.810*		*0.45[illegible]*		*0.55[illegible]*
K					$\overline{CU}$					
C	*500*	*0*		*400*		*450*		*550*		*425*

UPSTREAM SLOPE			
Trial	Slope	Conditions	Fs
1	~~*2½*~~ *3:1*	*Full drawdown - 10' berm @ elev. 1947.5 - Arc cut*	
		from opposite s[illegible] thru Zoned Emb of Shell	
		(24.5°-550) & Core (39.0°-450).	*1.97*
1A	~~*2½:1*~~ *3:1*	*Same as #1 except Shell (29.0°-425)*	*1.9[illegible]*

DOWNSTREAM SLOPE			
Trial	Slope	Conditions	Fs
2	*2½:1*	*[illegible] - No berm - Arc cut from opposite*	
		s[illegible] thru Zoned Emb of [illegible] Shell ([illegible]):	
		Downstream Shell (2[illegible]°-[illegible]) & Core (39.0°-450)	*2.[illegible]*
		Sat. slope values used [illegible]	

To be used to report to field offices data used for slope stability analyses and the results of the analyses. The right side of the form will be used for a sketch of the embankment on which the analyses have been made.

GPO : 1959 O - 469156

FORM SCS-357
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

Flood Plain Section
Sta 2+15

SUMMARY - SLOPE STABILITY ANALYSIS

State VIRGINIA Project JOHNS CREEK SITE #2

Date 11-11-66 Analysis Made By A.W.L. Checked By T.C.H.

Method of Analysis SWEDISH CIRCLE

Location of Material										
Sample No.										
γ_d										
γ_m	See sheet 1 of 8 for materials list									
γ_s										
γ_b										
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ										
Tan ϕ										
K										
C										

UPSTREAM SLOPE

Trial	Slope	Conditions	Fs
3	2½:1 / 3:1	Full drawdown - 10' berm @ elev 1347.5 - Arc	
		cut from top shell thru Emb & shell	
		(29°-425) & Core (39.5°-250) & Found (35.5°-0)	1.55
3A	2½:1 / 3:1	Same as #3 except Found (26°-500)	1.53
4	2½:1 / 3:1	Full drawdown - 10' berm @ elev 1347.5 -	
		Arc cut in same slope thru emb	
		of shell (29°-425) & 4' into found (35.5°-0)	1.58
4A	2½:1 / 3:1	Same as #4 except emb. shell (24.5°-550)	1.77
4B	2½:1 / 3:1	Same as #4 except Found (26°-500)	2.3

DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs

To be used to report to field offices data used for slope stability analyses and the results of the analyses.
The right side of the form will be used for a sketch of the embankment on which the analyses have been made.

FORM SCS-357
10-58

Sheet 5 of 8
Flood Plain Section
Sta 5+25

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State Virginia Project: John's Creek Site #2

Date 12-5-64 Analysis Made By T.C.H. Checked By A.W.L.

Method of Analysis Swedish Circle

Location of Material	Found CL									
Sample No.	65W563									
γ_d	89.4		See sheet 1 of 8							
γ_m			for other mat'ls							
γ_s	113.5									
γ_b	51.0									
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ		24.5°								
Tan ϕ		0.456								
K										
C		100								

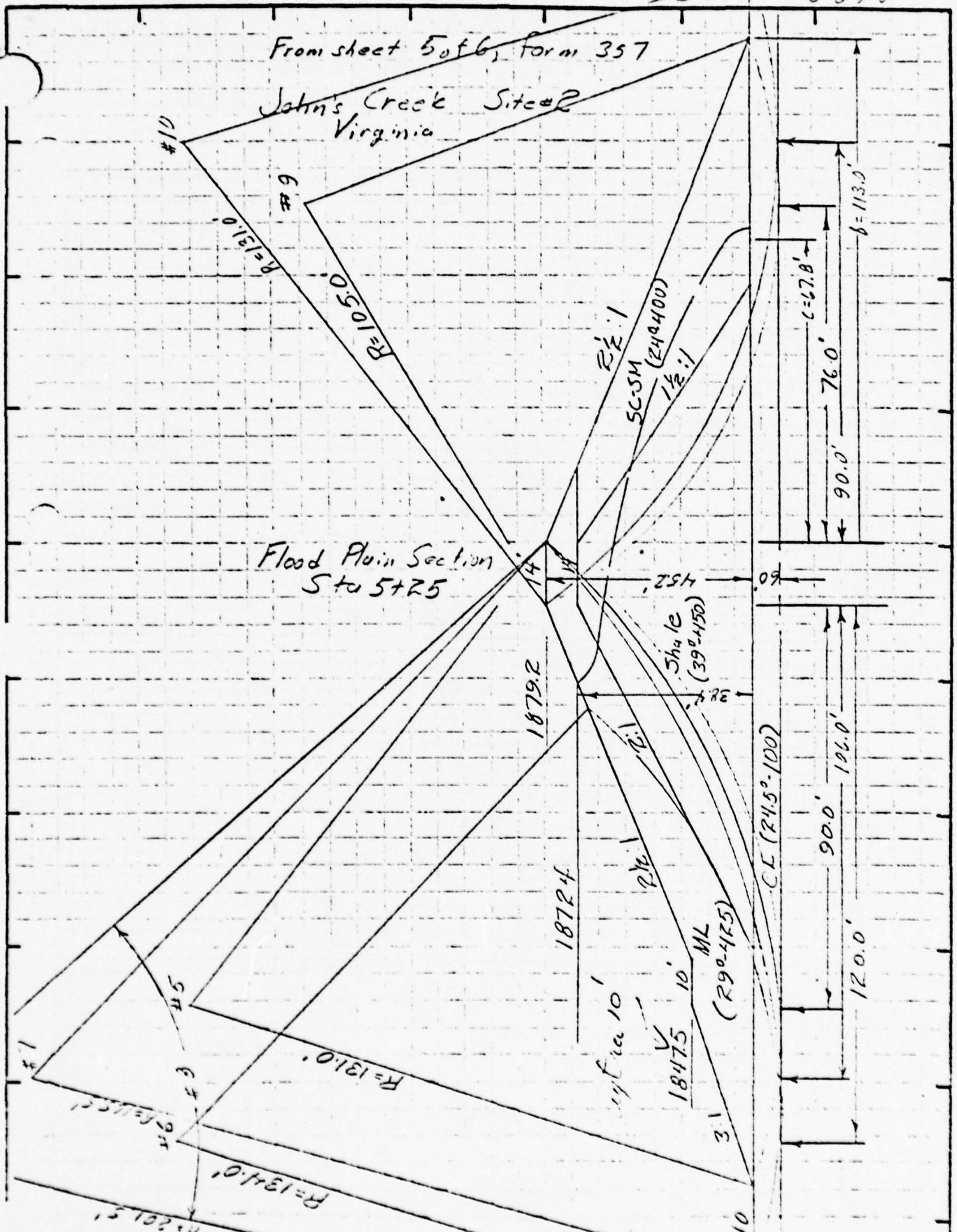
UPSTREAM SLOPE

Trial	Slope	Conditions	Fs
5	2½:1 / 3:1	Full draw down - 10' berm @ el 1847.5 - Arc cut from opp shldr thru *zoned emb & 6' found (24.5°-100) - Sat shear values only	1.43
6	2½:1 / 3:1	Full draw down - 10' berm @ el. 1847.5 - Arc cut from same slope thru emb ML (29°-425) & 6' found (24.5°-100) - Sat shear values only	1.62
4	2½:1 / 3:1	Same as #5 except 20' berm @ el. 1847.5	1.52
7	2½:1 / 3:1	Full draw down - 20' berm @ elev 1847.5 - Arc cut from opp shldr thru *zoned Emb & 6' Found (24.5°-100)	1.63
8	2½:1 / 3:1	Full draw down - 20' berm @ elev 1847.5 - Arc cut from opp shldr thru *zoned Emb & 6' Found (24.5°-100)	1.77
		"	

DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs
9	2½:1	[illegible] - No berm - Arc cut from opp shldr thru *zoned Emb & 6' Found [illegible]	[illegible]
10	2½:1	[illegible] - No berm - Arc cut from opp shldr thru *zoned Emb & 6' Found [illegible]	[illegible]
		Sat shear values used on all trials	
		* Zoned Emb. see [illegible] Sheet [illegible]	

To be used to report to field offices data used for slope stability analyses and the results of the analyses.
The right side of the form will be used for a sketch of the embankment on which the analyses have been made.


From sheet 5 of 6, form 357
John's Creek Site #2
Virginia
#10
#9
R=131.0'
R=105.0
2½:1
SC-SM (24°-400)
1½:1
Flood Plain Section
Sta 5+25
14
45.2'
60'
Shale (39°-450)
1879.2
1872.4
2:1
2½:1
ML (29°-425)
CL (24.5°-100)
10'
1847.5
3:1
#5
#3
#1
R=131.0'
R=134.0'
c=67.8'
76.0'
90.0'
b=113.0'
102.0'
90.0'
120.0'

FORM SCS-357
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

Sheet 7 of 3
Flood Plain Section
Sta 5+25

SUMMARY - SLOPE STABILITY ANALYSIS

State Virginia Project Towns Creek Site #2

Date 12-10-[illegible] Analysis Made By A.W.L. Checked By

Method of Analysis Swedish Circle

Location of Material										
Sample No.										
γ_d										
γ_m										
γ_s										
γ_b										
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ										
Tan ϕ										
K										
C										

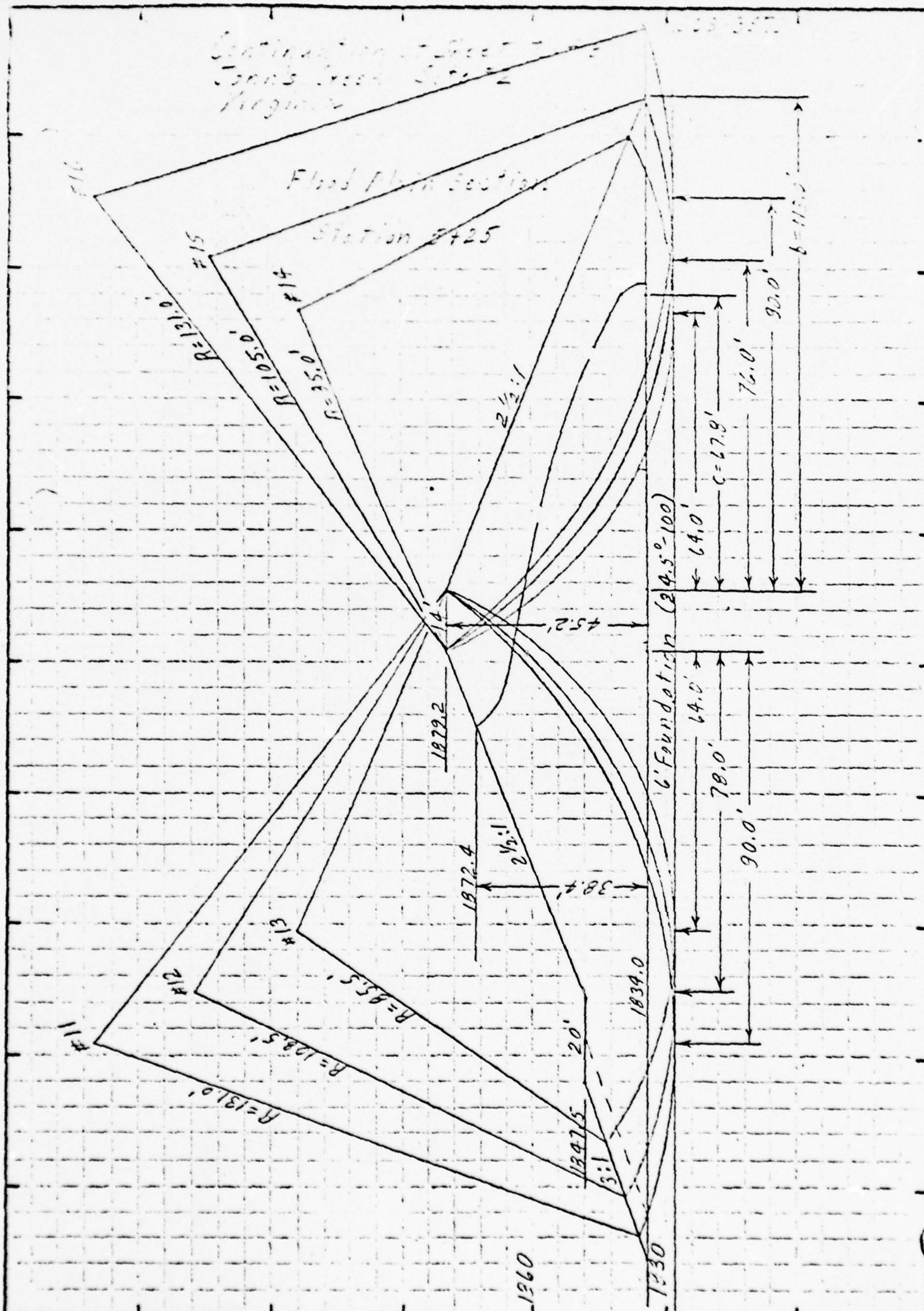
UPSTREAM SLOPE

Trial	Slope	Conditions	Fs
11	2½:1 / 3:1	Full drawdown - 10' berm @ elev 1237.5 - Arc cut	
		from app. slope thru Emb. (23.5°-550) &	
		Found. (29.5°-100)	1.21
11A	2½:1 / 3:1	Same as #11 except 20' berm @ elev. 1237.5	1.35
12	2½:1 / 3:1	Full drawdown - 20' berm @ elev 1237.5 - Arc cut from	
		app. slope thru Emb. (23.5°-550) & Found (29.5°-100)	1.32
13	2½:1 / 3:1	Full drawdown - 20' berm @ elev 1247.5 - Arc cut from	
		app. slope thru Emb. (23.5°-550) & Found (29.5°-100) "	1.37

DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs
14	2½:1	Drain @ ½ slope - No berm - Arc cut from app. slope	
		thru Emb. (23.5°-550) & Found (29.5°-100)	1.2[illegible]
15	2½:1	Drain @ ½ [illegible] - Arc cut from app. slope	
		thru Emb. (23.5°-550) & Found (29.5°-100)	[illegible]7
16	2½:1	Drain @ ½ [illegible] - Arc cut from app. slope	
		thru Emb. ([illegible]) & Found (29.5°-100)	[illegible]
		[illegible]	

To be used to report to field offices data used for slope stability analyses and the results of the analyses.
The right side of the form will be used for a sketch of the embankment on which the analyses have been made.



Scale 1 inch= 30 Feet

SCS-372
(3/59)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

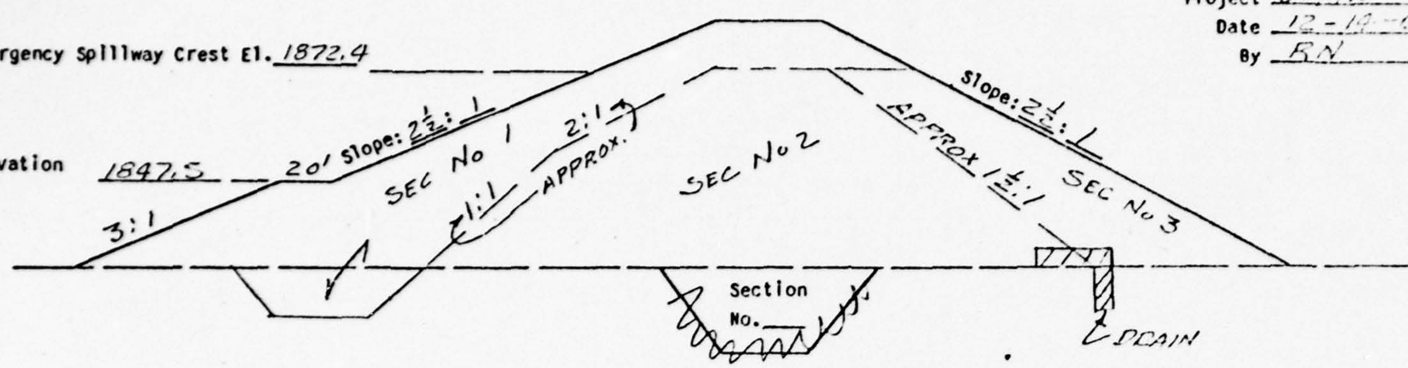
RECOMMENDED USE OF EXCAVATED MATERIAL

☐ Formal Zoning Plan ☐ Selective Placement Plan

State VIRGINIA
Project JOHNS [illegible]
Date 12-19-6[illegible]
By RN

Emergency Spillway Crest El. 1872.4

Elevation 1847.5



TYPICAL EMBANKMENT SECTION

Embankment Section		Source of Fill Material				Lab. Sample No.	Lab Test		Lab. Curve No.	Compaction Requirements Class of Fill		
Sec. No.	Description	Location		Ave. Depth			STANDARD			Minimum Density	Moisture Range	
				From	To	65W	Max. Den.	Optm. Moist.		Lbs. per Cu. Ft.	Percent From	To
1 & 3		E. SPILL.	CL	1	12	568	106.0	19.0	1	100.5		
1 & 3		"	ML	1	1.6	569	103.0	21.0	2	98.0		
2		"	SHALE	1	4	570			10	120.0*		
1 & 3		BORROW	CL	1	4.6	571	101.0	21.5	3	96.0		
1	BOTTOM PORTION & CUTOFF	"	CL	1	7.8	572	100.5	22.0	4	95.5		
1	" " "	"	CL	7.8	8.6	573	106.5	19.0	5	101.0		
3		"	SC-SM	1	3.7	574	113.5	14.5	6	[illegible]		
3		"	SC	3.7	6.3	575	117.5	13.0	7	111.5**		
1 & 3		"	CL	1	4.7	576	107.5	17.5	8	102.0*		
1 & 3		"	ML	1	9.6	577	103.0	21.0	9	98.0*		
	* MASS DENSITY →	REFER TO NARRAT		-	SUBJE	CT TO CHANGE.						
	* DENSITY BASED	ON MINUS No 4 F.		TION								

OPTIONAL FORM NO. 10
5010-104

R. C. Barnes

UNITED STATES GOVERNMENT

Memorandum

TO : R. C. Barnes, State Conservation Engineer, SCS, Richmond, Virginia 23240 DATE: January 20, 1965

FROM : Rey S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska 68508

SUBJECT: ENG - Soil Tests 22 - Virginia WP-08, Little Oregon Creek, Johns Creek, Site No. 2 (Craig County)

RE : Original Report dated December 15, 1965, and Mr. Mc Gourin's Memorandum to Mr. Decker dated January 5, 1965.

ATTACHMENTS

1. Form SCS-355, Triaxial Shear Test Data, 2 sheets.
2. Form SCS-357, Summary - Slope Stability Analysis, 9 sheets.

It was concluded from the original shear tests that strength of the shale, 65W570, was ample for a mass density of 120 p.c.f. and a gradation having 65% rock (plus No. 4) before compaction. The intent of the new test was to determine if the strength of this degrading material would be in the same range for a mass density of 120 p.c.f. and a gradation having only 35% to 40% rock. In addition, the shear strength of the minus No. 4 fraction was determined using a density of 109.2 p.c.f. which is approximately 95% of standard. A mass density of 120 p.c.f. is approximately 95% of standard based on the mathematical correction using 40% rock.

Results of these tests are summarized as follows:

Dry Density p.c.f.	% Sat. at Start	Lateral Pressure p.s.i.	Shear Pore Pressure p.s.i.	Corrected Lateral Pressure p.s.i.	Stress at Failure p.s.i.
Test No. 1, 65W570 (Reported December 15, 1964) Test density (mass), 125 p.c.f.; 65% rock before test 48% rock after test.					
126.1	93.7	10.0	-0.4	10.4	61.4
126.1	92.1	20.0	-0.2	20.2	99.5
127.4	90.2	30.0	+0.5	29.5	129.1
			$\bar{\phi} = 39.5°$, $\bar{c} = 850$ p.s.f.		
Test No. 2, 65W570 (Reported December 15, 1964) Test density (mass), 120 p.c.f; 65% rock before test 58% rock after test.					

Continued on next page.

Rey S. Decker
Subj: ENG - Soil Tests 22 - Virginia WP-08, Little Oregon Creek, Johns Creek, Site No. 2 (Craig County)

Dry Density p.c.f.	% Sat. at Start	Lateral Pressure p.s.i.	Shear Pore Pressure p.s.i.	Corrected Lateral Pressure p.s.i.	Stress at Failure p.s.i.
Test No. 2 - Continued					
119.2	85.9	10.0	+0.05	9.95	48.0
120.5	88.0	20.0	+0.4	19.6	83.8
120.5	91.3	30.0	+0.1	29.9	118.1
			$\bar{\phi}$ = 39°, $\bar{c}$ = 450 p.s.f.		
Test No. 3, 65W570 - New Test Test density (mass), 120 p.c.f.; 40% rock before test 38% rock after test.					
121.1	91.9	10.0	+1.0	9.0	40.5
119.9	95.4	20.0	+4.0	16.0	60.2
121.1	93.9	30.0	+10.0	20.0	80.5
	ϕ = 30°, c = 850 p.s.f.; $\bar{\phi}$ = 39°, $\bar{c}$ = 350 p.s.f.				
Test No. 4, 65W570 - New Test Test density (Minus No. 4), 109 p.c.f.					
109.2	87.1	10.0	+2.8	7.2	31.4
109.2	89.0	20.0	+5.3	14.7	54.3
109.2	87.1	30.0	+7.3	22.7	83.6
	ϕ = 34.5°, c = 200 p.s.f.; $\bar{\phi}$ = 39°, $\bar{c}$ = 200 p.s.f.				

You will note that pore pressure measured during Test No. 1 was negative for the 10 and 20 p.s.i. test specimens. Negative pore pressure is added to the lateral pressure to obtain the effective lateral stress. Pore pressures measured in Test Nos. 1 and 2, original tests, are small and can be neglected. The resulting Mohr's envelop is interpreted as describing the effective stress parameters. Pore pressures measured in the new tests are significant and the interpretation includes total stress and effective stress parameters.

The decision to use a 20-foot upstream berm is not based on the strength of embankment material, but on the strength of the foundation, Sample

No. 65W563 (ϕ = 24.5°, c = 100 p.s.f.). You will note that the same requirement is indicated by the original analyses using effective stress values from the shale for the embankment core, sheet Nos. 5 and 6, and using total stress values from Sample 65W746, Site No. 3, for the embankment, sheet Nos. 7 and 8. There is apparently no advantage in reducing the quantity of shale in the embankment. The sketch on sheet Nos. 6 and 8 should be corrected to show a 20-foot berm on the upstream slope.

The additional analyses indicate the following:

1. Two and one-half to one slopes are adequate without modification for the embankment alone using total stress values of ϕ = 34.5°, c = 200 p.s.f. from the test on minus No. 4 material or effective stress values of ϕ = 39°, c = 350 p.s.f. from the test with 120 p.c.f. mass density and 40% rock.

2. At ℄ Station 5+25 the foundation strength is limiting and a 30-foot upstream berm is required for a factor of safety of 1.35 with total stress values of ϕ = 34.5°, c = 200 p.s.f. or for a factor of safety of 1.5 with effective stress values of ϕ = 39°, c = 350 p.s.f. in the embankment.

3. A 20-foot upstream berm is required with the new values assuming that foundation shear strength is ϕ = 35.5°, c = 0 (℄ Station 2+15).

CONCLUSIONS

A. The effect of foundation strength was not pointed out clearly in the original report. In reviewing the foundation shear data it is apparent that the higher density soils tested have relatively high strength. Refer to the direct shear test for 65W563 where dry density was over 100 p.c.f. and to the triaxial test for 65W565 where the 20 and 30 p.s.i. test specimens had densities of 1.52 gm/cc, 95 p.c.f.

You may wish to consider removing the weak foundation material (that with a dry density of less than 95 p.c.f.), and omitting the berm proposed originally. If this is not feasible, it is recommended that you hold to the use of a 20-foot upstream berm as the original analyses indicated. This is applicable to ℄ location B as well as ℄ location A. At ℄ location B there will be more of the Allen Series soil available (a reduced quantity of the shale), which is assumed to be similar to that from Site No. 3 as covered by the original analyses.

B. We think that the control for the shale can be set up under Class A compaction (new specification) specifying a density of 120 p.c.f. for

rock contents between 35% to 40% and 65% instead of specifying a percent of a standard test. The E & WP Unit can provide guidance on this.

Please submit a Form SCS-356 in the amount of $101.62 to cover engineering costs for additional slope stability analyses.

Prepared by:

Robert E. Nelson

Reviewed and Approved by:

Roland B. Phillips

Attachments

cc: R. C. Barnes (5)
H. M. Kautz, Upper Darby, Pa.
G. W. Grubb, Upper Darby, Pa.

FORM SCS-357
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State *Virginia* Project *John's Creek Site 2*

Date *1-15-65* Analysis Made By *T.C.H.* Checked By *F.W.L.*

Method of Analysis *Swedish Circle*

From site 1

Location of Material			Emb 95% Std SC-SM		Emb 120 PCF Shale		Emb 95% Std ML			
Sample No.			64W3552-52		65W1570		65W5777			
γ_d			110.6		120.0		[illegible]			
γ_m			127.5		132.0		119.0			
γ_s			131.5		136.0		123.5			
γ_b			69.0		73.5		61.0			
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ				24.0°		34.5°		25.0°		
Tan ϕ				0.445		0.687		0.554		
K					CU					
C				400		200		425		

Additional Analyses

UPSTREAM SLOPE			
Trial	Slope	Conditions	Fs
1	~~2½:1~~ 3:1	Full drawdown - 10' berm @ el 1847.5 - Arc cut from opp shldr thru zoned emb only - Sat shear values only	1.48

DOWNSTREAM SLOPE			
Trial	Slope	Conditions	Fs
2	2½:1	Drain @ ½ to 0.6 - No berm - Arc cut from opp shldr thru* zoned emb only Sat shear values only	1.35
		*See sketch sheet 3 of 3 for emb zoning	
		*Core ct(34.5°-200)	

USDA-SCS-LINCOLN NEBR 1958

FORM SCS-357
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

Sheet 2 of 9
Maximum Section

SUMMARY - SLOPE STABILITY ANALYSIS

State Virginia Project Johns Creek Site #2

Date 1-16-68 Analysis Made By A.W.L. Checked By T.G.H.

Method of Analysis Swedish Circle

From Site #1

Location of Material					Emb. 955-?2 SC-SM		F... 120... Sh...		Emb. 955-Std ML	
Sample No.					12W553-52		65W570		65W577	
γ_d					110.4		[illegible]		98.4	
γ_m					127.5		[illegible]		119.0	
γ_s					131.5		[illegible]		123.5	
γ_b					69.0		73.5		61.0	
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ						24.0°		50.0°		29.0°
Tan ϕ						0.445		[illegible]		0.554
K							$\overline{CU}$			
C						400		350		425

Additional Analyses

UPSTREAM SLOPE

Trial	Slope	Conditions	Fs
1A	~~2½:1~~ 3:1	Full drawdown - 10' berm @ elev. [illegible] - Arc	
		cut from opp. shldr thru *zoned emb. only -	
		Sat. shear values only used.	1.82

DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs
2A	2½:1	Drain @ d/b = 0.6 - No berm - Arc cut from opp.	
		shldr thru *zoned emb. only - Sat. shear	
		values only used.	2.2
		* See Sheet 3 of 9 for zoned Emb.	
		* Core (29.0° - 350)	

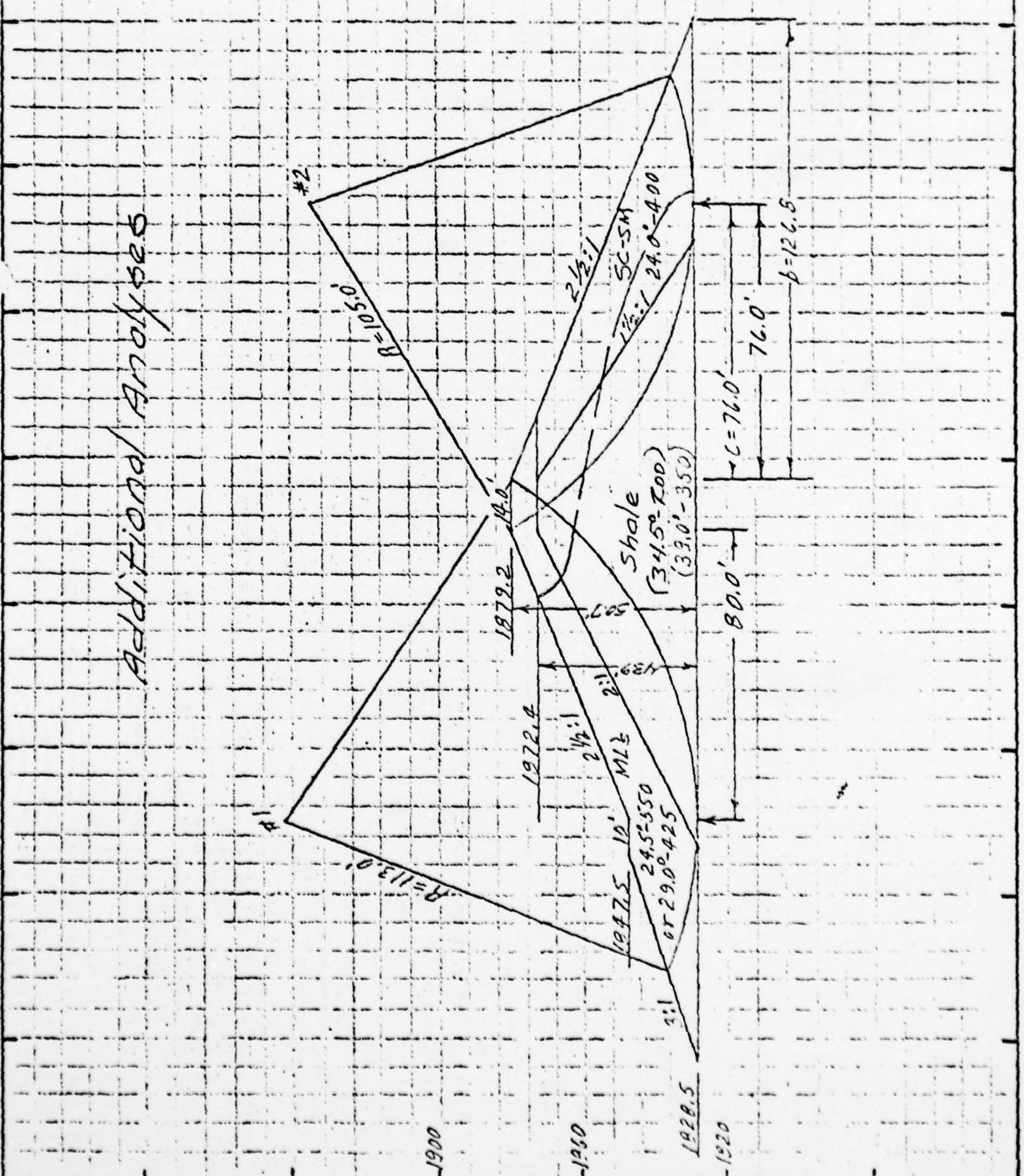
To be used to report to field offices data used for slope stability analyses and the results of the analyses.
The right side of the form will be used for a sketch of the embankment on which the analyses have been made.

GPO : 1959 O -489388

Continuation of Sheet [illegible]
Johns Creek Site #2
Virginia

Maximum Section

Station 4+00



Scale 1 inch = 40.0 Feet

FORM SCS-357
10-56

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

Sheet [illegible]
Flood Plain Section
Sta 5+25

SUMMARY - SLOPE STABILITY ANALYSIS

State Virginia Project John's Creek Site #2

Date 1-15-65 Analysis Made By T.C.H. Checked By A.W.L.

Method of Analysis Swedish Circle

Additional Analyses

Location of Material	Found CL				Emb 955.5 [illegible] SC-SM		Emb 120 P.C.F. Shale		Emb 959.5 d ML	
Sample No.	65W563				65W550-52		65W570		65W577	
γ_d	89.4				110.8		120.0		98.4	
γ_m					127.5		132.0		119.0	
γ_s	113.5				131.5		136.0		123.5	
γ_b	51.0				69.0		73.5		61.0	
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ		24.5°				24.0°		[illegible]		29.0°
Tan ϕ		0.456				0.445		0.657		0.554
K							CU			
C		100				400		200		225

UPSTREAM SLOPE			
Trial	Slope	Conditions	Fs
3	~~2½:1~~ 3:1	Full drawdown- 10' berm @ el 1847.5- Arc cut	
		from opp shldr thru *zoned emb & 6.0'	
		found CL (24.5°-100)- Sat shear values only	1.15
3A	~~2½:1~~ 3:1	Same as #3 except 30' berm @ el. 1847.5	1.38
4	~~2½:1~~ 3:1	Full drawdown- 30' berm @ el 1847.5- Arc cut	
		from opp shldr thru *zoned emb & 6.0'	
		found CL (24.5°-100)- Sat shear values only	1.36
5	~~2½:1~~ 3:1	Full drawdown- 20' berm @ el. 1847.5- Arc cut	
		from opp shldr thru *zoned emb & 6.0'	
		found CL (24.5°-100)- Sat shear values only	1.38

DOWNSTREAM SLOPE			
Trial	Slope	Conditions	Fs
6	2½:1	Drain @ %b=0.6- No berm- Arc cut from opp	
		shldr thru *zoned emb & 6.0' found	
		CL (24.5°-100)- Sat shear values only	1.40
6A	2½:1	Same as #6 except 10' berm @ el. 1850.0	1.52
7	2½:1	Drain @ %b=0.6- No berm- Arc cut from opp	
		shldr thru *zoned emb & 6.0' found	
		CL (24.5°-100)- Sat shear values only	1.58
8	2½:1	Drain @ %b=0.6- 10' berm @ el 1850.0- Arc cut	
		from opp shldr thru *zoned emb & 6.0' found	
		CL (24.5°-100) - Sat shear values only	1.73
———	——→	*See sketch for zoning - [illegible] (24.5°-100)	

SOM-81

FORM SCS-357
10-56

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State *Virginia* Project *[illegible]*

Date *1-18-65* Analysis Made By *A.W.L.* Checked By

Method of Analysis *Swedish Circle*

Location of Material	Found / ML			Emb [illegible] SC-SM		Emb [illegible]		Emb [illegible] ML	
Sample No.	65W565			64W550-52		65W570		65W577	
γ_d	67.9			110.5		126.0		98.4	
γ_m				127.5		132.0		119.0	
γ_s	112.0			131.5		134.0		123.5	
γ_b	49.5			69.0		72.5		61.0	
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ		24.5°				22.0°		39.0°		29.0°
Tan ϕ		0.456				0.445	CU	0.810		0.554
K										
C		100				400		250		225

Additional Analyses

UPSTREAM SLOPE

Trial	Slope	Conditions	Fs
3B	2½:1 3:1	Full drawdown - 30' berm @ elev 1[illegible] - Arc cut from opp sh'ld'r thru *zoned emb't & found	
		(24.5°-100)	1.61
13	2½:1 3:1	Full drawdown - 30' berm @ elev 1[illegible] - Arc cut from opp sh'ld'r thru *zoned emb't & found	
		(24.5°-100)	1.96
14	2½:1 3:1	Full drawdown - 20' berm @ elev 1[illegible] - Arc cut from opp sh'ld'r thru *zoned emb't & found	
		(24.5°-100)	1.58

DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs
6B	2½:1	Drain @ %=0.6 - No berm - Arc cut from opp sh'ld'r thru *zoned emb't & 6.0' found (24.5°-100)	1.60
7	2½:1	Drain @ %=0.6 - No berm - Arc cut from opp sh'ld'r thru *zoned emb't & 6.0' found (24.5°-100)	1.63
8	2½:1	Drain @ %=0.6 - No berm - Arc cut from opp sh'ld'r thru *zoned emb't & 6.0' found (24.5°-100)	1.72
		*Zoned emb - core (39.0°-[illegible])	
		*Zoned emb - See Sketch [illegible]	

To be used to report to field offices data used for slope stability analyses and the results of the analyses. The right side of the form will be used for a sketch of the embankment on which the analyses have been made.

FORM SCS-357
10-65

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State Virginia Project Johns Cr[illegible]

Date 1-15-65 Analysis Made By T.C.H Checked By [illegible]

Method of Analysis Swedish Circle

Location of Material	Found ML			Emb. 955 St[illegible]		Emb. [illegible] Shale		Emb. [illegible]	
Sample No.	65W555			65W550-[illegible]		65W570		65W577	
γ_d	87.9			110.6		12[illegible]		[illegible]	
γ_m				127.5		15[illegible]		[illegible]	
γ_s	112.0			131.5		13[illegible]		12[illegible]	
γ_b	49.5			69.0		[illegible]		61.0	
Condition	~~Opt.~~ Sat.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ	26°[illegible]	35.5°				26[illegible]		[illegible]		[illegible]°
Tan ϕ	0.483	0.713				0.[illegible]		[illegible]		[illegible]
K							0.11			
C	500	0				[illegible]		[illegible]		425

Additional Analyses

UPSTREAM SLOPE			
Trial	Slope	Conditions	Fs
9	2½:1 / 3:1	Full drawdown - 10 berm @ el [illegible]47.5 - [illegible] cut	
		from ups shldr thru* zoned emb [illegible] 6.0'	
		found ML - (35[illegible]) - Sat shear [illegible]	1.27
9A	2½:1 / 3:1	Same as # 9 except 20 [illegible] el [illegible]	1.36
9B	2½:1 / 3:1	Same as # 9 except found ML (26[illegible])	1.56
10	2½:1 / 3:1	Full draw down - No berm - Arc cut from ups	
		shldr thru* zoned emb & 6.0' found ML	
		(35.5°-0) - Sat shear values only	1.43
11	2½:1 / 3:1	Full drawdown 20' berm @ el 1147.5 - Arc cut	
		from ups shldr thru* zoned emb & 6.0'	
		found ML (35.5°-0) Sat shear values only	1.36

DOWNSTREAM SLOPE			
Trial	Slope	Conditions	Fs
12	2½:1	Drained [illegible] - No berm - Arc cut from dns	
		shldr thru* zoned emb & 6.0' found	
		ML (35.5°-0) - [illegible] shear values only	1.75
12A	2½:1	Same as # 11 except found ML (26[illegible])	1.89
		*See sketch for emb [illegible]	
		[illegible] values (32.5°-[illegible])	

USDA-SCS-LINCOLN NEBR 1966

SOM-61

FORM SCS-357
10-55

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Flood Plain Sec-
Sta [illegible] +15

SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State Virginia Project Johns Creek [illegible] Site #2

Date 1-19-[illegible] Analysis Made By T.C.H. Checked By

Method of Analysis Swedish Circle

Location of Material	Found ML				Emb 95% std SC-SM		Emb Shale		Emb 95% std ML	
Sample No.	65W1565				65W3[illegible]		65W570		65W1577	
γ_d	87.9				110.[illegible]		1[illegible]		98.4	
γ_m					127.5		137.0		119.0	
γ_s	112.0				131.5		13[illegible]		123.5	
γ_b	49.5				69.0		73.5		61.0	
Condition	~~Opt.~~	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ	26.0°	35.5°				24.0°		38.0°		29.0°
Tan ϕ	0.488	0.713				0.445		0.810		0.554
K							$\overline{CU}$			
C	500	0				400		350		425

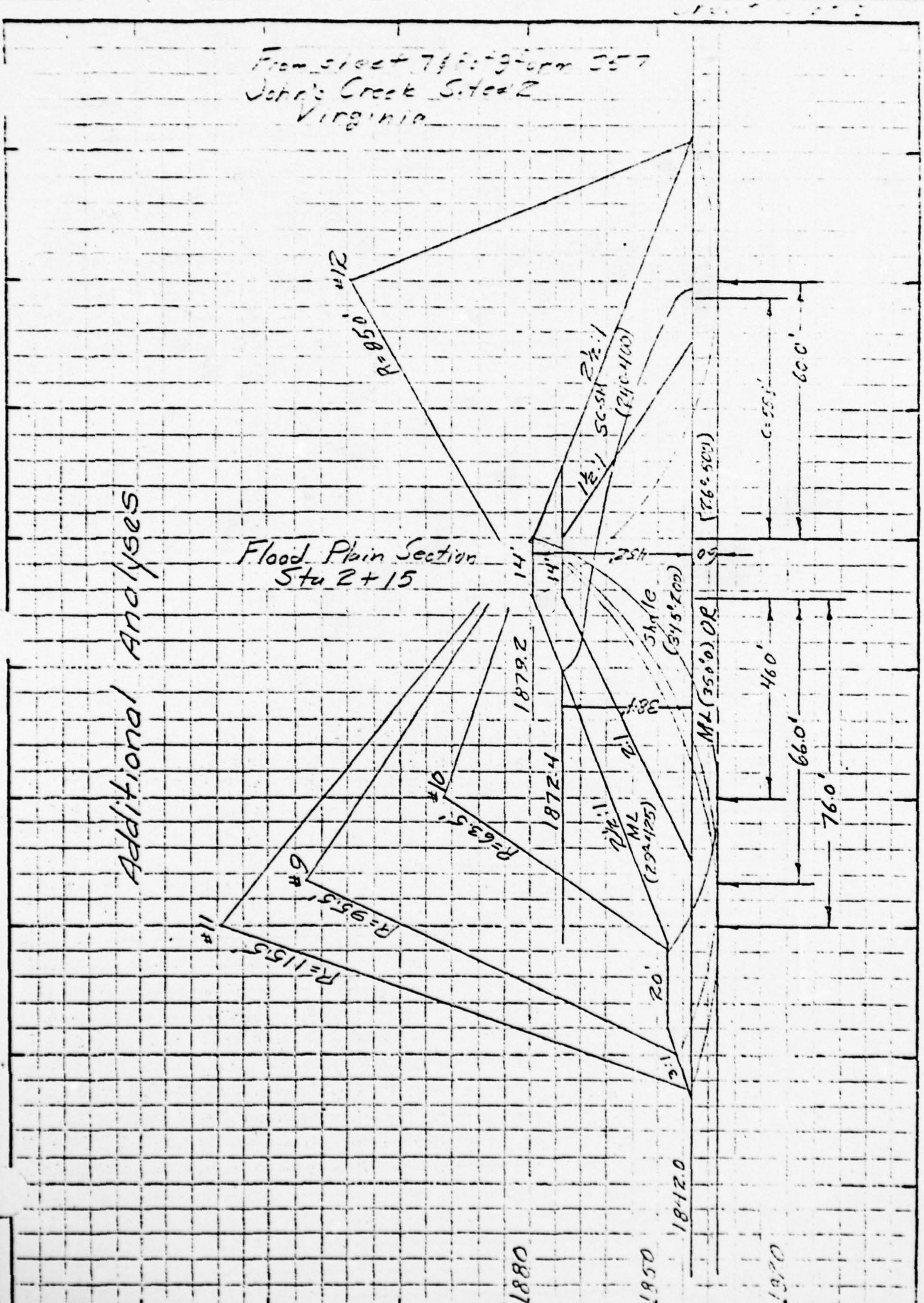
Additional Analyses

UPSTREAM SLOPE

Trial	Slope	Conditions	Fs
9C	2½:1 / 3:1	Full drawdown - 10 berm @ el 1847.5 - Arc cut	
		from opp shldr thru zoned emb [illegible]	
		found ML - (35.5° 0) - Sat shear values only	1.[illegible]
10A	2½:1 / 3:1	Full drawdown - No berm - Arc cut from opp	
		shouldr thru *zoned emb & 6.0' found	
		ML - (35.5° 0) - Sat shear values only	[illegible]
11A	2½:1 / 3:1	Full drawdown - 10 berm @ [illegible]847.5 - Arc cut	
		from opp shldr thru *zoned emb & [illegible]	
		found (35.5° 0) - Sat shear values only	1.50

DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs
12B	2½:1	Drain @ [illegible] = 0.6 - No berm - Arc cut from	
		opp shldr thru zoned emb & [illegible] found	
		ML (35.5° 0) - Sat shear values only	
		* See sketch for zoning	
		Core (38° - 350)	



Scale 1 inch = 30 Feet

APPENDIX VII

GEOLOGIC REPORT

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

GENERAL

State Virginia County Craig Watershed Johns Creek

Subwatershed Little Oregon Creek Fund class ______ (FP-2, WP-1, etc.) Site number 2 Site group I Structure class b

Investigated by T. Mack (signature and title) Equipment used [illegible] Date [illegible]/64

SITE DATA

Drainage area size 5.63 sq. mi. 3603.5 acres. Type of structure [illegible] Purpose Flood Prevention

Direction of valley trend (downstream) east Maximum height of fill 43.2 feet. Length of fill 600 feet

Estimated volume of compacted fill required 104,639 yards

STORAGE ALLOCATION

	Volume (ac. ft.)	Surface Area (acres)	Depth at Dam (feet)
Sediment	69	11.4	18
Floodwater	780	53.2	42

SURFACE GEOLOGY AND PHYSIOGRAPHY

Physiographic description Ridge & Valley Topography mountainous Attitude of beds: Dip 20-40 Strike ______

Steepness of abutments: Left 30 percent; Right 33 percent. Width of floodplain at centerline of dam 20 feet

General geology of site: Johns Creek Site #2 is underlain by black, generally fissile shale of the Millboro formation. This formation here is a black fissile shale with oblate mud balls that range in diameter from 1 to 4 feet. The rock shows no reaction with HCl. The lithology of Millboro Formation here is typical of the formation at its type locality at Millboro Springs, Bath County, Virginia.* When weathering takes place the black carbonaceous matter present oxidizes. This changes the color of the Millboro shale from black to tan or dun colored. Oxidation of any ferric iron present makes red blotches on the weathered rock. The Millboro black shale is the product of barred basin sedimentation. Recently this type of sedimentation has received much investigation due to the large oil deposit found in this material in such localities as the Permian Basin in Texas and the Williston Basin in North Dakota. Of course all hydrocarbons have left the Millboro shale in the folding and compression which it has undergone. This Devonian environment was a limestone or beach enclosed reef-type basin into which silt and organic matter slowly accumulated.

The formations that enclosed this thick (700 feet, plus) black shale are the Oriskany sandstone or the Helderberg limestone. Thus, parts of these latter formations are contemporary in age to parts of the Millboro shale. In this area the Onondaga formation, the Helderberg group and the Cayugan group were not found after a cursory examination and are presumed to be either thin or absent. The absence of the Helderberg when a thick section of the Millboro is present is typical. This is to be expected as one cuts through the central section of the barred basin. The Millboro black shale is generally highly fractured. The joint planes occur at approximately 60 degree angles to a line normal to the direction of the thrust force. This shows that the Millboro has nothing of the competence of the sandstone formations present. Besides jointing, a small strike slip fault was observed that has branched into a dendrite pattern .

Little Oregon Creek and Johns Creek form part of the James River System. Little Oregon Creek flows in a trellis pattern. This stream is now degrading. The height of the terraces above the stream is increasing rapidly. This is shown by the presence of fossil mottles present in the Holston soil. The topography has reached late youth to early maturity. The hard indurated sandstone formations, such as the Clinch Tuscarora quartzite and the Oriskany sandstone, form the ridges with shales such as the Millboro shale and the Brallier shale forming the valleys. For a small stream, Little Oregon Creek shows remarkable terrace development. Terraces of medium height that have Holston and Monongahela soils occur at the proposed dam location. At the toes of the slopes Leadvale and Allen soils occur. The Allen is the older colluvium. It has been weathered to a red color by podzolization. The residual soil present over the Millboro is the shallow Muskingum series.

Methods and Procedures -

1. Two dam foundations were investigated. The centerlines of these proposed dams are 150 feet apart. The primary investigation was on the downstream location. This location has been designated as location A. This location was thought to be the better for the excavation of the emergency spillway. However, the geologic investigation showed red colluvial Allen soil to be present in much of the emergency spillway that would be excavated if the upstream foundation were chosen. The upstream location has been designated as location B.

*Butts, Charles, 1940, Geology of the Appalachian Valley in Virginia: Virginia Geol. Survey Bull. 52, p. 308.

2. Soil material that was investigated for use in construction is classified according to the standard agricultural soil system. This is only to keep the soil types separate. The reader need not be familiar with the agricultural descriptions of these soils. The engineering descriptions of these soils should show that different soil series have markedly different engineering properties. Also it is noticeable that soils of the same series have similar engineering properties. As the agricultural soil classification system is the only means of showing these properties, there is no choice except to use it.

3. Four seismic velocities were clocked in the Millboro shale that occurs in the emergency spillway of the downstream location. Any surface conditions that would reflect on these velocities were recorded.

4. Two resistiviter surveys were made in the foundation of the downstream location. The resistiviter shows the presence of water. It does not show the permeability of the rock. However, from the presence of water the planes of water movement can be inferred.

5. Dry densities were made by use of the Speedy Moisture tester. Volume of the material tested was determined by use of water and Saran Wrap. The specific instrument used has not been calibrated. However, the standard calibration chart compiled by the Alpha-Lux Company was used. From attempts made to calibrate other Speedy Moisture Testers this standard chart appears to be as close an approximation as can be obtained.

6. Two coarse grained samples were taken. One sample of the minus three-inch material was submitted for sieve analysis. As the two coarse grained samples appear similar in their coarse gradation, the fine gradation can also be presumed to be similar.

7. Permeability tests were conducted. From these results k was determined as set up in the temporary forms.

8. The pocket penetrometer was used as a guide to determine the bearing strength of the soil in the foundation. Also given with many of these readings is the moisture content as determined by the Speedy Moisture Tester. From these two readings a better conclusion can be drawn on the bearing strength of the foundation.

9. Two cut undisturbed samples were taken.

Centerline of the Dam -
Location A

To identify the material present under the centerline of this proposed location, 6 test pits -- TP 1 through 6 and 4 auger holes -- A7 through 11 were dug. These showed that on each side of the stream there occurs a medium height bench and a steep slope. The bench on the left abutment has a terrace soil that has three layers present. The highest of these is a layer of topsoil that has a thickness of 0.3 feet. Below this is a moderately loose layer of brown to brown red plowed material (DS 2-1). This material still carries the marks of tillage. It is medium in strength and has a blocky loose structure that shows the presence of former roots. This layer ranges in depth from 1.2 to 1.7 feet. The lowest layer of the soil present is a medium aged terrace alluvium. Near the stream this layer is a sandy silty gravel (DS 1-1) that shows the predominating influence of alluvial sedimentation. In the central part of the bench this layer is a silty sand that has fossil mottles. These mottles make this soil resemble a Monongahela soil. However, other characteristics such as its maturity, position, and compactness give it more characteristics of a Holston soil. The Holston series is a hard, indurated moderately old terrace soil. Near the slope colluvial influence appears on this terrace soil. This influence appears as a browner color and some subangular coarse sand of shale pieces. The depth of this soil on the left abutment ranges from 5.8 to 7.7 feet. On the slope above this bench there is present a shallow residual soil that ranges in depth from 0.5 to 3.9 feet. The deeper layer of this soil contains a yellow brown sandy silt. The terrace on the right abutment is higher than the terrace on the left abutment. Here on the right abutment there occurs a moderately high terrace soil. The alluvial soil here has generally three layers present. The highest of these is a brown topsoil that has a depth of 0.4 to 0.7 feet. Below this layer is a layer of medium strength plowed material that ranges in depth up to 1.1 feet. Below this is a layer of hard terrace alluvium that ranges in depth from 3.5 to 5.1 feet (US 5-1). This material has all the characteristics of a hard, compact, moderately high terrace soil. The mottles present are not considered to be active and thus do not show the possibilities of a high water table at this height above the stream. There is present in this layer on this abutment no area of gravelly material. However, colluvial influence near the toe of the hill is strong on this terrace. Test pit 6 is in a deep Leadvale soil. As typical of the transition zone between a colluvial and an alluvial soil the silt present

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percent to 13.2 percent. The material is tight and only slightly permeable. In the proposed seepage drain area, which is located 75 feet downstream from the centerline of this proposed location, the dry density ranges from 95.6 to 97.8 pounds per cubic foot. The moisture ranges from 9.7 percent to 10.3 percent. The k factor here ranges from 3.79 to 4.15 cubic feet/square foot/day. The colluvial material blends into the alluvial terrace soil. A slight change from a silty sand texture to a clayey sand texture occurs. However, generally the physical properties of the colluvial soil are almost similar to those of the alluvial terrace soil. Little Oregon Creek flows over a rock bed through this foundation. The lithology and structure of this rock was logged. The joints, joint sets and faults present are tight. They do not receive any water into the planes present in the creek bed. The fact that no water is present in these joint and fault planes at depth is shown by the two resistiviter surveys that were taken. These showed no water to be present in the area of the electrical survey. The structural features present in this rock were the result of compression at depth. Under these conditions sealing of cracks is often accomplished.

Location B

In Location B the seepage drain will fall on TP 401 and TP 402. The terrace soil present in these test pits has been previously described. The foundation conditions for this location will generally approximate those that occur in Location A. However, a minor part of this foundation will rest in the alluvial stream plain. The soil here has 0.5 feet of topsoil present, 1.1 to 1.9 feet of brown silty sand, and approximately 1.6 feet of gravel. This soil lies over gray fissile shale.

Emergency Spillway

Location A

Test pits 201 through 213 and auger holes 214 through 220 were used in investigating this emergency spillway which is located on the left abutment. Two soil types occur here. Deep red colluvial Allen series occurs upstream from station 3+00 on the centerline of the emergency spillway. This soil has 0.5 feet of topsoil. Beneath this layer is over 12 feet of red yellow to yellow red fine sandy silt. No rock was found in this colluvial soil at a depth of 12.2 feet. Downstream from station 3+00 on the centerline of the emergency spillway shallow Muskingum series occurs. This soil has a topsoil that is approximately 0.5 feet thick. Below this

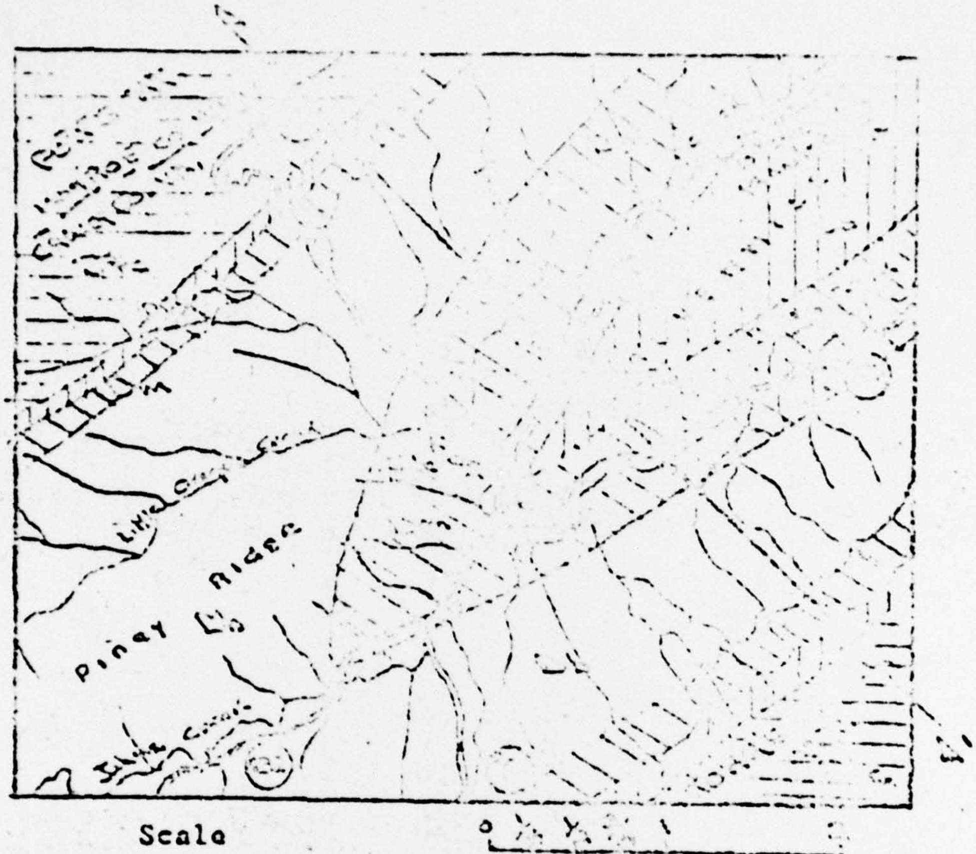
layer there occurs a layer of brown yellow fine sandy silt that ranges in thickness from 0 to 2 feet. Slightly weathered shale occurs at shallow depths under this soil. At 50' right of station 6+45 an outcrop of olive brown shale occurs. The black fissile shale present is fractured to considerable extent. Mud balls that range in diameter from 1 to 3 feet are common.

Location B

Test pits 250 through 253 and auger holes 255 through 257 were used to investigate this proposed emergency spillway, which is located on the left abutment. Red Allen series soil occurs on the right side of this proposed spillway. On the left side shallow Muskingum series soil occurs. Fractured black fissile shale occurs below the shallow Muskingum soil which ranges in depth from 1.0 - 1.7 feet.

Borrow Area

The borrow area is located in the sediment pool area and on two benches each on either side of the flood plain. To investigate this borrow area 31 test pits, test pits 101 through 131 were dug. These showed that the colluvial soil in the flood plain area is shallow. This borrow area is designated as borrow area A. Here the Pope series that generally occurs in the upper end of the sediment pool has 0.4 feet of topsoil below which is approximately 3.5 feet of red brown silty sand. Below this latter layer is approximately 2.6 feet of yellow brown mottled clayey sand. The Philo series that occurs generally in the lower end of the sediment pool has approximately 4.3 feet of mottled brown silty sand lying below 0.4 feet of topsoil. In some test pits water occurs above the gray and green shale bedrock. Also gravels occur in some test pits above the shale. The bench that occurs on the right side of the flood plain contains an alluvial Holston soil on its surface nearest to Little Oregon Creek. This soil has approximately 4.5 feet of brown yellow to pale yellow brown sandy silt to silty sand below a topsoil layer that has a thickness of approximately 0.4 feet. The portion of this bench nearest the toe of the hill is covered by a rather deep Leadvale soil. Below the 0.4 of topsoil this soil has a B horizon of approximately 7.0 feet of brown silty sand that is often mottled with gray. A layer approximately 2 feet thick of gray mottled fine sandy silt underlies the B horizon material in this soil. The influences of weathering and former passage of water from the hill slopes through this colluvial soil are apparent. The darker shades of brown, the gray mottling, and the red brown mottling are evidences



Scale

Devonian

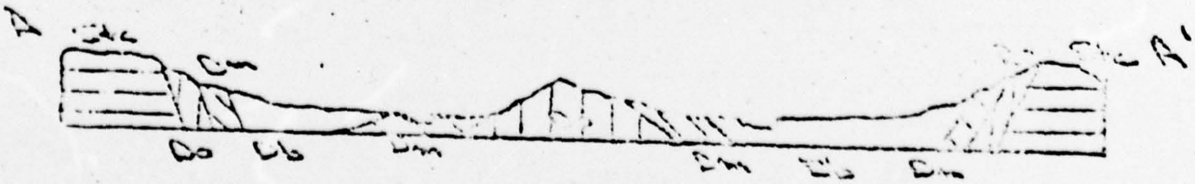
Db — Brallier green shale interbedded with sandstone

Oriskany white sandstone

Dm — Millboro black fissile shale

Silurian

Clinch Tuscarora sandstone and quartzite



Geologic map* of the area surrounding Dam Sites #2, 3 & 4, Johns Creek Watershed, Craig County, Virginia

*Modified from Butts, Charles 1933, Geologic Map of the Appalachian Valley of Virginia: Virginia Geol. Survey, Bull. 42. VA 492 G

Johns Creek [illegible] 2 Va. [illegible], T. 8/64

Representative Sample for Lab.									
Field No.	Depth From - To	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
			121	0.5-3.3	ML	Borrow Area			
			122	0.4-2.0	ML	"			
			123	0.4-2.1	SM	"			
			125	0.5-1.9	SM	"			
109-2	3.7-6.3	SC	109	3.7-6.3	SC	"	Slopes & Core	9,000	Pope Series
			108	4.3-5.7	SC	"			
			114	2.5-4.7	SM	"			
			115	2.9-5.0	SC	"			
			121	3.5-6.1	CL	"			
			122	2.0-3.1	SM	"			
			123	2.1-4.4	CL	"			
			125	1.9-4.8	SM	"			
113-1	1.0-4.7	SM	113	0.4-4.7	SM	"	Slopes	9,000	Philo Seric
			117	0.5-6.6	ML	"			
			126	0.5-5.3	SM	"			
130-1	1.0-9.6	ML	130	0.5-9.6	ML	"	Core	25,000	Leadvale Series
			111	0.4-7.3	ML	"			
			117	0.5-6.6	ML	"			
			131	0.4-11.7	ML	"			

Johns Creck 2 Va. Mack, T. 8/64

201-1	1.0-12.2	ML	201	0.5-12.2	ML	E Spillway	Core	5,000	Allen series
			207	0.5-4.1	ML	"			
			208	2.0-6.5	ML	"			
			251	0.5-9.0	ML	"			
			253	0.5-8.5	ML	"			
202-1	1.0-1.6	ML	202	0.5-1.6	ML	"	Shell	6,000	Muskingum series
			203	0.6-1.2	ML	"			
			204	0.5-1.0	ML	"			
			205	0.5-1.0	ML	"			
			211	0.6-1.2	ML	"			
			214	0.3-1.2	ML	"			
			215	0.4-2.9	ML	"			
			216	0.4-1.3	ML	"			
			217	0.6-1.4	ML	"			
			218	0.4-2.5	SM	"			
			219	0.6-3.7	ML	"			
			220	0.7-1.5	ML	"			
			250	0.3-1.0	ML	"			
			252	0.5-1.3	ML	"			
			255	0.3-1.0	ML	"			
			256	0.5-1.7	ML	"			
			257	0.6-1.3	ML	"			

SCS [illegible] Unit
Upper Darby, Pa.
January 16, 1962

John Creek 2 Va. Mack, T. 8/64

203-1	1.2-4.1		203	1.2-4.1$^+$		Spillway	Downstream Slopes	60,000	Shale
			202	1.6-4.1$^+$		"			
			204	1.0-4.1$^+$					
			205	1.0-3.1$^+$					
			206	0.5-4.9$^+$					
			208	6.5-6.6$^+$					
			209	0.6-4.1$^+$					
			210	0.6-3.6$^+$					
			211	1.2-3.6$^+$					
			212	0.6-5.2$^+$					
			213	0.3-1.5$^+$					
			214	1.2-1.3$^+$					
			215	2.9-3.0$^+$					
			216	1.3-1.5$^+$					
			217	1.4-1.5$^+$					
			218	2.5-3.8$^+$					
			219	3.7-3.8$^+$					
			220	0.7-1.6$^+$					
			250	1.0-3.1$^+$					
			252	1.3-4.1$^+$					
			255	1.0-1.1$^+$					
			256	1.7-1.9$^+$					
			257	1.3-1.5$^+$					

SCS EWP Unit
Upper Darby, Pa.
January 10, 196[illegible]

Sheet 5 of 5 VA 492-G

APPENDIX VIII

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GENERAL REFERENCES

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